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Bibliography

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Epitome

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(57) [Abstract]
[Objects of the Invention] Even if it uses fluid lubrication agents with comparatively high viscosity, such as oil, for a fluid hydrodynamic bearing, there are few torque losses, a motor efficiency can be planned, and it can manufacture easily.
[Elements of the Invention] It is a motor possessing the hydrodynamic bearing means C and D by fluid

lubrication agent which intervened between the quiescence member 1, the revolution member 3 by which relative revolution support is carried out to said quiescence member 1, and said quiescence member 1 and said revolution member 3. A dynamic pressure generating slot is established in either of said quiescence member 1 which faces, and said revolution member 3, and the taper-like gap section to which this gap becomes large one by one towards said dynamic pressure generating edge outside rather than a radial gap by said quiescence member 1 in said dynamic pressure generating slot and said revolution member 3 is prepared in said hydrodynamic bearing means C and D at a dynamic pressure generating edge side of said dynamic pressure generating slot. And said fluid lubrication agent was applied to an oil-repellent **** oil repellent agent by part except the real up aforementioned dynamic pressure generating slot and said taper-like gap section in like a bearing support which said revolution member 3 and said quiescence member 1 counter.

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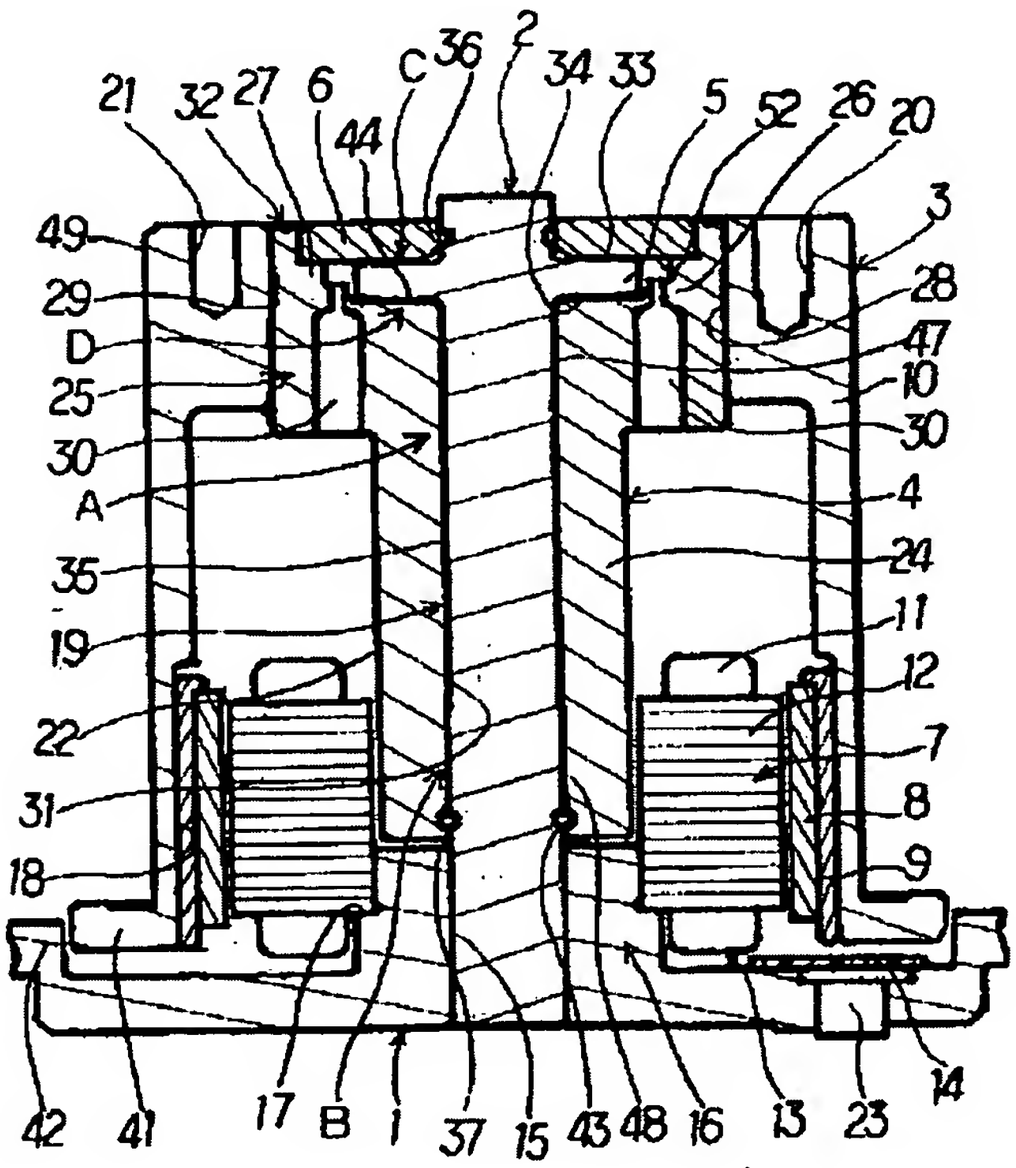

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CLAIMS

[Claim(s)]
[Claim 1] A quiescence member A revolution member by which relative revolution support is carried out to said quiescence member A hydrodynamic bearing means by fluid lubrication agent which intervened between said quiescence members and said revolution members It is the motor equipped with the above. For said

hydrodynamic bearing means A dynamic pressure generating slot is established in either of said quiescence member which faces, and said revolution member. To a dynamic pressure generating edge side of said dynamic pressure generating slot Rather than a radial gap by said quiescence member in said dynamic pressure generating slot, and said revolution member The taper-like gap section to which this gap becomes large one by one towards said dynamic pressure generating edge outside is prepared. It is characterized by what said fluid lubrication agent was applied to an oil-repellent **** oil repellent agent for by part except the real up aforementioned dynamic pressure generating slot and said taper-like gap section in like a bearing support which said revolution member and said quiescence member counter.

[Claim 2] A quiescence member A revolution member by which relative revolution support is carried out to said quiescence member A hydrodynamic bearing means by fluid lubrication agent which intervened between said quiescence members and said revolution members It is the motor equipped with the above. For said hydrodynamic bearing means The dynamic pressure generating pattern section is prepared in either of said quiescence member which faces, and said revolution member. This dynamic pressure generating pattern section A predetermined dynamic pressure generating pattern is formed of an oil-repellent **** oil repellent agent in said fluid lubrication agent. To a dynamic pressure generating edge side of said dynamic pressure generating pattern section Rather than a radial gap by said quiescence member in said dynamic pressure generating pattern section, and said revolution member The taper-like gap section to which this gap becomes large one by one towards said dynamic pressure generating edge outside is prepared. It is characterized by what said fluid lubrication agent was applied to an oil-repellent **** oil repellent agent for by part except the real up aforementioned dynamic pressure generating slot and said taper-like gap section in like a bearing support which said revolution member and said quiescence member counter.

[Claim 3] A manufacture method of a motor characterized by what said oil repellent agent is removed for in real up aforementioned both processing part by being the manufacture method of manufacturing a motor according to claim 1, applying said oil repellent agent to a bearing support which said revolution member and said quiescence member counter beforehand, and then processing said dynamic pressure generating slot and said taper-like gap section.

[Claim 4] A manufacture method of a motor characterized by what said oil repellent agent is removed for in real up aforementioned both processing part by being the manufacture method of manufacturing a motor according to claim 2, applying said oil repellent agent to a bearing support which said revolution member and said quiescence member counter beforehand, and then processing a dynamic pressure generating pattern of said dynamic pressure generating pattern section, and said taper-like gap section.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the motor which used the hydrodynamic bearing for a part for bearing.

[0002]

[Description of the Prior Art] For example, while the brushless motor included in a record disk driving gear etc. supports a revolution member to high degree of accuracy on the property of an actuation load, the accurate revolution support which suppressed the deflection and the backlash as much as possible is required. In order to meet such a demand, from the conventional ball bearing, it is transposed to the hydrodynamic bearing means using fluid lubrication agents, such as oil and air, by the amount of bearing, and the configuration accompanying

it is variously proposed. Thereby, revolution nonuniformity, an oscillation, etc. are reduced and highly precise bearing support is realized. With the hydrodynamic bearing means using oil, grease, etc. especially as a fluid lubrication agent, according to such viscosity which it has, bearing rigidity becomes high and good bearing support can be gained to a big revolution load.

[0003]

[Problem(s) to be Solved by the Invention] According to the above-mentioned bearing means, while bearing rigidity can be made high, the viscosity of the intervening oil or grease itself acts as loss to the generating torque of a motor. For this reason, if it is the motor of the same configuration, lowering of torque or the increment in mounting current will not be avoided, but will make the effectiveness of a motor fall. According to a dynamic pressure generating part, the viscosity of lubricant is used properly, and it is proposed that a loss torque is reduced as much as possible in order to cope with such a problem, for example, as indicated by JP,62-4565,B. However, in the inclination of a miniaturization and lightweight-izing of the motor in recently, the above-mentioned policy became complicated on the structure or a manufacturing process, it was hard to say that it is not necessarily suitable, and a certain cure was desired. In addition corresponding to the lubricant to treat, a policy which prevents the break through to bearing or the motor exterior of lubricant was also desired again.

[0004] Even if it uses fluid lubrication agents with comparatively high viscosity, such as oil, for a dynamic pressure liquid bearing, there are few torque losses, and the place which this invention is performed in view of the above troubles which consisted in the conventional technology, and is made into the technical problem can plan effectiveness of a motor, and is to provide the easy motor list of manufacture with the manufacture method moreover. Moreover, it is in offering the motor which combines and can prevent a break through of a fluid lubrication agent, and its manufacture method.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned technical problem, a motor concerning this invention A quiescence member and a revolution member by which relative revolution support is carried out to said quiescence member, In a motor possessing a hydrodynamic bearing means by fluid lubrication agent which intervened between said quiescence members and said revolution members for the; aforementioned hydrodynamic bearing means A dynamic pressure generating slot is established in either of said quiescence member which faces, and said revolution member. To a dynamic pressure generating edge side of said dynamic pressure generating slot Rather than a radial gap by said quiescence member in said dynamic pressure generating slot, and said revolution member Inside like a bearing support in which the taper-like gap section to which this gap becomes large one by one towards said dynamic pressure generating edge outside is prepared and which the; aforementioned revolution member and said quiescence member counter, A part except the real up aforementioned dynamic pressure generating slot and said taper-like gap section comes to apply said fluid lubrication agent to an oil-repellent **** oil repellent agent.

[0006] Moreover, a revolution member by which relative revolution support of another motor concerning this invention is carried out to a quiescence member and said quiescence member, In a motor possessing a hydrodynamic bearing means by fluid lubrication agent which intervened between said quiescence members and said revolution members for the; aforementioned hydrodynamic bearing means The dynamic pressure generating pattern section is prepared in either of said quiescence member which faces, and said revolution member. This dynamic pressure generating pattern section A predetermined dynamic pressure generating pattern is formed of an oil-repellent **** oil repellent agent in said fluid lubrication agent. To a dynamic pressure generating edge side of the; aforementioned dynamic pressure generating pattern section Rather than a radial gap by said quiescence member in said dynamic pressure generating pattern section, and said revolution member Inside like a bearing support in which the taper-like gap section to which this gap becomes large one by one towards said dynamic pressure generating edge outside is prepared and which the; aforementioned revolution member and said quiescence member counter, A part except the real up aforementioned dynamic pressure generating slot and said taper-like gap section comes to apply said fluid lubrication agent to an oil-repellent **** oil repellent agent.

[0007] Real up aforementioned both processing part is provided with a manufacture method of a motor that said oil repellent agent is removed, by applying said oil repellent agent to a bearing support which said revolution member and said quiescence member counter beforehand, and then processing said dynamic pressure generating slot and said taper-like gap section into it as the manufacture method of furthermore manufacturing a motor of the former of this invention.

[0008] Furthermore, real up aforementioned both processing part is provided with a manufacture method of a motor that said oil repellent agent is removed, by applying said oil repellent agent to a bearing support which

said revolution member and said quiescence member counter beforehand, and then processing a dynamic pressure generating pattern of said dynamic pressure generating pattern section, and said taper-like gap section into it as the manufacture method of manufacturing a motor of the latter of this invention.

[0009]

[Function] According to the motor of this invention, the fluid lubrication agent is applied to the oil-repellent **** oil repellent agent in like the bearing support which a revolution member and a quiescence member counter by the part except the real up aforementioned dynamic pressure generating slot and the taper-like gap section. For this reason, for an oil-repellent ****** reason, in like a bearing support, a fluid lubrication agent is held at least for the section of the hydrodynamic bearing means accompanying dynamic pressure generating by only the ** taper-like gap section, and a fluid lubrication agent piles up by the part by which the oil repellent agent is applied. And even if the taper-like gap section receives an operation so that a fluid lubrication agent may move, it makes the seal means held in a predetermined gap portion by the surface tension and capillarity which balance corresponding to the applied force. Therefore, at least with the other supporter with which a revolution member and a quiescence member counter, a fluid lubrication agent does not exist on parenchyma, but a fluid lubrication agent is held only to the part of a hydrodynamic bearing means effective in dynamic pressure generating, and the part of the seal means (taper-like gap section) of break-through prevention. For this reason, the load torque by which a revolution member is supported is reduced and it becomes possible to stop the torque loss of a motor effectively also as **** for fluid lubrication agents with high viscosity.

[0010] Moreover, as the manufacture method of such a motor, the oil repellent agent is beforehand applied at least to the bearing support, and spreading of the part of a dynamic pressure generating slot and the taper-like gap section is removed by next processing a hydrodynamic bearing means in that case. For this reason, even if it does not apply an oil repellent agent selectively, since it can carry out easily, manufacture becomes easy. By this, even if components become small or serve as a complicated configuration with the miniaturization of a motor, it can apply easily, and a manufacturing cost can be reduced.

[0011] And according to the motor of the latter of this invention, the dynamic pressure generating pattern section in which the dynamic pressure generating pattern was formed of the oil repellent agent is prepared in the hydrodynamic bearing means. Therefore, since the dynamic pressure generating section is prepared without preparing a dynamic pressure generating slot in addition to the above-mentioned operation, a manufacturing cost can be reduced more. In addition, while the load torque of a fluid lubrication agent is reduced and being able to stop a torque loss, break-through prevention of a fluid lubrication agent can also be aimed at.

[0012] Furthermore, as the manufacture method of the above-mentioned motor, an oil repellent agent is similarly applied at least to a bearing support beforehand, and in case a hydrodynamic bearing means is processed and the dynamic pressure generating pattern section and the taper-like gap section process it, the gap section and a ********** oil repellent agent are removed. For this reason, it is not necessary to apply an oil repellent agent selectively and, and can apply easily also to a complicated configuration, and reduction of a manufacturing cost can be aimed at.

[0013]

[Example] The example of the motor according to this invention is explained referring to an attached drawing. Drawing 1 is a motor for carrying out revolution actuation for example, of the record disk, and is the cross section showing the whole. Drawing 2 is the important section expanded sectional view having expanded and shown a part of drawing 1 . And drawing 3 and drawing 4 are the fragmentary sectional views having expanded and shown drawing 2 . Furthermore, drawing 5 and drawing 6 are the cross sections or side elevations of a member which were shown in drawing 1 .

[0014] In these drawings, housing 1 is formed from an aluminum containing alloy, and the boss section 16 formed by upheaving up (interior side of a motor) is formed in the core. In the center section, a pore 15 is formed in the boss section 16, and the soffit section of a shaft 2 is being inserted in and fixed to it. The shaft 2 is vertically attached on parenchyma to the clamp face of housing 1. It is formed from the iron machine alloy etc. and, as for the shaft 2, the thrust plate 5 which makes disc-like to an upper bed section side is formed in one. The thrust plate 5 is formed so that the field of the vertical edges 33 and 34 may serve as a real Kamitaira line, while being formed in a right angle on parenchyma to the direction of straight side (axial center) of a shaft 2. In addition, it makes with the quiescence member of this motor by housing 1 and the shaft 2.

[0015] As a thrust plate 5 is shown in drawing 6 , in the vertical edges 33 and 34, the slots 45 and 46 for dynamic pressure generating of the shape of a herringbone formed annularly are formed. And in the periphery edge, the tapered form tapers 38 and 39 with the thickness of homogeneity of the vertical edges 33 and 34 are formed in the hoop direction, respectively. On the other hand, the diameter reduction section 35 which reduced the diameter more slightly than the outer-diameter size of the periphery section 19, and was formed is formed

in the abbreviation center section in the periphery section 19 of a shaft 2. And the periphery sections 47 and 48 which have the peripheral face formed with the predetermined outer-diameter size are formed in the both sides of the vertical direction. The radial hydrodynamic bearing sections A and B are constituted by the sleeve 4 which the periphery sections 47 and 48 are radially attached outside with these, and meets. The slots 50 and 51 for dynamic pressure generating of the shape of a herringbone formed in the hoop direction as shown in drawing 5 are established in the corresponding point of the inner circumference section 31 of a sleeve 4.
[0016] Rota (revolution member) 3 by which revolution support is carried out has the sleeve 4 which makes approximate circle tubed, and the hub 10 fixed at the periphery side of a sleeve 4 at the shaft 2. A hub 10 is formed from an aluminum containing alloy, the record disk (graphic display abbreviation) as for example, a revolution load attaches it outside the periphery section 49, and it is equipped with it. The collar 41 of a hub 10 is for a record disk to catch, and is a dog hole for the baffle at the time of a pore 20 fixing a clamp member and the screwhole of a ** sake with picking and a pore 21 fixing a record disk.
[0017] A sleeve 4 consists of a cylinder-like peripheral wall 24 which occupies the greater part of the overall length, and the diameter expansion section 25 prepared in the upper part at one, and these are formed in the shape of the same axle to the shaft 2. The sleeve 4 is formed from copper alloy materials, such as lead bronze. Steps 26 and 27 are formed in the diameter expansion section 25 of a sleeve 4 at the inner circumference side, and two breakthroughs 30 and 30 penetrated in the direction of an axis are formed in the step 26 in the shape of the symmetry of revolution. The upper bed section 44 of the peripheral wall 24 in a sleeve 4 counters in the soffit section 34 and the vertical (shaft) direction of a thrust plate 5, and the thrust hydrodynamic bearing section D of the thrust plate bottom is constituted by the slot 46 for dynamic pressure generating.
[0018] The thrust covering 6 is formed in the up inner circumference side of a sleeve 4. As for the thrust or the bar 6, caulking **** immobilization of the slot of the sleeve upper bed section 32 is carried out. And the soffit section 52 of the thrust covering 6 and the upper bed section 33 of a thrust plate 5 counter in the vertical (shaft) direction, and the thrust hydrodynamic bearing section C of the thrust plate bottom is constituted by the slot 45 for dynamic pressure generating. It fills up, it has and Rota 3 is supported free [a revolution] to a shaft 2 so that it may be placed between these hydrodynamic bearings A, B, C, and D by the oil which is all a fluid lubrication agent.
[0019] A step 17 is formed in the periphery upper part at the boss section 16 of housing 1, and the stator 7 is being fixed to the step 17. It comes to wind a stator coil 11 around the stator core 12 in which a stator 7 has a predetermined magnetic pole gear tooth. The coil lead wire 13 pulled out from the stator coil 11 is connected to the flexible circuit board 14 stuck on housing, and the path cord which carries out a graphic display abbreviation further is drawn through an insulating bushing 23 in the motor exterior. The hub 10 side which countered to a stator 7 and radial is equipped with the Rota magnet 8 through the magnetic yoke 9.
[0020] Although oil is intervened and prepared in the hydrodynamic bearing sections A, B, C, and D in the motor of this example by each, the maintenance condition of the oil is hereafter explained further focusing on drawing 3 and drawing 4 . Oil is held by capillarity at the gap in the thrust hydrodynamic bearing sections C and D, i.e., the gap of the soffit section 52 of the thrust covering 6, and the upper bed section 33 of a thrust plate 5, the gap of the soffit section 34 of a thrust plate 5, and the edge 44 of a sleeve 4, and *********. Since the up-and-down taper sections 38 and 39 are formed in the periphery side of a thrust plate 5, even if the migration and fluctuation of oil by a revolution, a halt, etc. of a motor occur, the oil held in each gap (taper-like gap section) is a gap between the taper sections 38 and 39, and is held by the position which balances it according to an operation of surface tension and capillarity and which balanced. Therefore, in these parts, it makes with a seal means to absorb fluctuation of oil substantially. And the oil repellent agent etc. is not applied to each of these corresponding field.
[0021] The annular space 53 which resembles the annular wall 55 formed successively to a step 27 and the soffit section 52 of the thrust covering 6, and is blockaded more from the edge 44 of a sleeve 4 is generated by periphery one end of a thrust plate 5. When the impact to a motor etc. is added, even if the oil by which it was placed between the hydrodynamic bearing sections C and D disperses to space 53, it is caught and held in the annular wall 55 and edge 44 grade (sleeve 4) in space 53, and, as it thinks best, is collected to the original hydrodynamic bearing sections C and D. Oil is applied to an oil-repellent **** oil repellent agent by the front face which specifies space 53, and on it, it is planned so that the slippage of oil may be raised. In addition, the motor exterior and space 53 are open for free passage, and the atmospheric-pressure difference of the motor inside-and-outside section is canceled by the breakthrough 30 prepared in the step 26. For this reason, even if the air contained in oil etc. by the temperature rise of a motor expands, oil is not extruded in the motor exterior. The opening 54 of a breakthrough 30 is formed in the upper bed of a step 26 for making it the oil which dispersed and piled up on the edge 44 etc. not have a breakthrough 30 to leakage appearance easily.

[0022] The soffit section 80 of the inner circumference section 57 in the thrust covering 6 is formed in the shape of a taper (taper section 80). Thereby, the taper-like gap section is formed between the taper section 80 and a thrust plate 5 (and shaft periphery section 19), even if it receives applied force so that the oil of the thrust hydrodynamic bearing section C may move in the direction of the motor exterior (upper part of drawing), it is held in this gap section and the parenchyma top seal effect is acquired. The oil repellent agent is not applied to the field of the portion which these-corresponds. Furthermore, it counters radially with the thrust covering 6 (inner circumference section 57), and the circular sulcus 36 is formed in the periphery section of a shaft 2. Leaking the oil by which an opening 56 is generated by this and it is placed between the hydrodynamic bearing sections C to the motor exterior (upper part of drawing) according to an operation of surface tension is prevented. The oil repellent agent is applied to the shaft periphery section 19 which specifies an opening 56, its circular sulcus 36, and the thrust covering inner circumference section 57, respectively, and it is planned so that a break through of oil may be raised more.
[0023] On the other hand, also in the hydrodynamic bearing section B located in the sleeve 4 bottom, the taper section 40 is formed in the soffit side (thereby, the taper-like gap section is generated), and it is considering as the seal means of the oil by which it is placed between the hydrodynamic bearing sections B at the sleeve inner circumference section 31 according to the same operation as ****** and the above-mentioned taper sections 38 and 39. And it counters radially with the circular sulcus 37 established in the periphery section 19 of a shaft 2, and this, a circular sulcus (prepared in the sleeve 4) 43 is resembled, an opening 58 is generated more, and the break through to the motor exterior (lower part of drawing) of oil is prevented. In order to raise these oil break-through prevention, the oil repellent agent is applied to the circular sulcus 37 of a shaft 2 which specifies an opening 58, and the circular sulcus 43 of a sleeve 4. In addition, the oil repellent agent is not applied to the taper section 40 and the outer-diameter section 48 of the shaft 2 corresponding to this.
[0024] A radial-clearance size is larger than a gap size with the hydrodynamic bearing sections A and B, the interstitial segment of the hydrodynamic bearing sections A and B, i.e., that between the sleeve inner circumference section 31 and the shaft diameter reduction section 35, is set up, and the opening 59 is formed. By the opening 59, the oil held at the hydrodynamic bearing sections A and B is isolated mutually. Oil is applied to the oil-repellent **** oil repellent agent by the sleeve inner circumference section 31 corresponding to an opening 59. In addition, the oil repellent agent is not applied to the slots 50 and 51 for dynamic pressure generating in the sleeve inner circumference section 31. Moreover, in the periphery section 19, rear-spring-supporter spreading is carried out on the whole surface of the outer-diameter section 47 and the diameter reduction section 35 at the shaft 2 side. In addition, it cannot be overemphasized that spreading of an oil repellent agent can be variously chosen as it the side which faces according to processing or a configuration corresponding to the part (this example the sleeve inner circumference section 31 side) in which the dynamic pressure generating slot was established.
[0025] As for oil, in oil-repellent **** and a spreading side, the slippage of oil is raised by spreading of these oil repellent agents by the oil repellent agent. For this reason, oil will not pile up other than the hydrodynamic bearing sections A and B (correcting and removing the taper-like gap section), therefore only the portion which oil contributes to dynamic pressure generating in the hydrodynamic bearing sections A and B on parenchyma will hold and pile up. And since oil does not intervene on parenchyma in an opening 59, oil can act only on a part for the bearing support by dynamic pressure (hydrodynamic bearings A and B), and it can suppress the load torque by the viscosity which oil has to necessary minimum. That is, compared with the former with which oil was filled up into the part of an opening 59, according to this motor, the torque loss by oil can be reduced effectively and a motor with high effectiveness can be obtained. In order to raise especially bearing rigidity, in case hyperviscous oil, grease, etc. are used, improvement in a motor efficiency can be aimed at.
Simultaneously, on the motor outside (under drawing) of the hydrodynamic bearing section B, the operation of an oil repellent agent is raising the seal effect of oil.
[0026] Also in the hydrodynamic bearing sections C and D which make the thrust bearing section at the above so that clearly, the oil repellent agent is applied in addition to the dynamic pressure generating section (and taper-like gap section), and the same effect is made. By applying an oil repellent agent to parts other than the dynamic pressure generating section for performing bearing support, a torque loss can be reduced and the external-leakage appearance of the oil by the surface tension of an oil repellent agent can be prevented further. As an oil repellent agent, fluorine system resin materials, such as trade name SAITOPPU of Asahi Glass Co., Ltd., are used, for example.
[0027] In this example, in the hydrodynamic bearing sections A and B, although the slots 50 and 51 for dynamic pressure generating are established in the sleeve 4 side, it may replace with this, and can prepare in a shaft 2 side, or these both combination is sufficient. It is desirable not to apply an oil repellent agent to the part to

which the slot for dynamic pressure generating was prepared in the case of which, but to apply an oil repellent agent to the other part. Similarly, it can replace with the dynamic pressure generating slots 45 and 46 established in the thrust plate 5, can prepare in a thrust covering 6 side [which counters respectively], and sleeve 4 side in the hydrodynamic bearing sections C and D, and is possible also in such combination. And spreading of an oil repellent agent can be performed in addition to the part in which the slot for dynamic pressure generating was established.

[0028] Next, the method of application of an oil repellent agent is explained. Although it becomes difficult so that it becomes a complicated appearance with the miniaturization of a motor, the following manufacture procedures can perform easily carrying out an oil repellent agent only to a predetermined part and a specific predetermined part. That is, in the case of the brushless motor of the configuration of a graphic display, first, impregnation of the whole is beforehand carried out to an oil repellent agent, it applies in a shaft 2, in the shaft simple substance shown in drawing 6 , and the slots 45 and 46 for dynamic pressure generating are formed in plastic working by the press, or cutting after that. While the slots 45 and 46 for dynamic pressure generating are formed in the vertical edges 33 and 34 of the thrust plate 5 which is a processing side by this, an oil repellent agent is removed. Moreover, an oil repellent agent is removed also for the taper sections 38 and 39 in that case.

[0029] Moreover, with a sleeve 4, in the sleeve simple substance shown in drawing 5 , beforehand, impregnation of the whole is carried out to an oil repellent agent, and it is applied to it. And the slots 50 and 51 for dynamic pressure generating of the sleeve inner circumference section 31 are formed by processing of plastic working, cutting, etc. like the above after that. Thereby, as for the processing part of the sleeve inner circumference section 31, an oil repellent agent is removed. Moreover, an oil repellent agent is removed also for the taper-like section 40 of a sleeve 4 in that case.

[0030] According to the above-mentioned method, the entire component is sunk in beforehand, an unnecessary part is removed from after that, the process of clearance is combined with processing of a dynamic pressure generating slot, and this, the taper-like gap section is combined and formation processing is performed. For this reason, regardless of the magnitude and the configuration of components, it can apply easily, and the time and effort of spreading can be reduced substantially. Various methods, such as injecting an oil repellent agent besides the method of sinking into the container containing the above-mentioned oil repellent agent as spreading processing of an entire component, can be used. Moreover, even when the slot for dynamic pressure generating besides the above-mentioned example is established in the partner member side which constitutes the hydrodynamic bearing section, it cannot be overemphasized that it processes in the same procedure.

[0031] Next, another example of this invention is explained using drawing 7 . Although the hydrodynamic bearing sections A, B, C, and D in the already explained motor were based on the dynamic pressure generating slots 50 and 51 (all are radial dynamic pressure) shown in drawing 5 and drawing 6 , and 45 and 46 (all are thrust dynamic pressure), as for these, the rear-spring-supporter oil repellent agent was removed for the portion in which the dynamic pressure generating slot was established in the whole region, respectively. However, the configuration shown in drawing 7 is prepared in this example. In drawing 7 , the example in which the dynamic pressure generating section was prepared in the upper bed section 79 side of a thrust plate 70 is shown. (a) is the plan seen toward the bottom from the top, and (b) is a cross section in X-X. The portion cut in drawing is the dynamic pressure generating slot 71, and the portion which protruded is the oil repellent agent spreading section.

[0032] Or in drawing 7 , as shown in a cross section (c), the portion cut in reverse is made into the oil repellent agent spreading section 73, and (b) is good also considering the portion which protruded as a dynamic pressure generating slot 74. By applying these oil repellent agents, the dynamic pressure generating pattern by the oil repellent agent is generated by correlation with the portion to which the oil repellent agent is not applied, and, thereby, the hydrodynamic bearing section is constituted. A corresponding point is removed, when all apply the oil repellent agent to the whole surface beforehand and these form a dynamic pressure generating slot. In (b) of drawing, the oil repellent agent is completely applied to the thrust plate side which has the irregularity by which outline formation was carried out, processing corresponding to a slot 71 can be performed, the oil repellent agent of a slot 71 is removed in that case, and an oil repellent agent remains in heights. Moreover, in the case of (c), the oil repellent agent is applied completely beforehand, the dynamic pressure generating section 74 which protruded is processed, an oil repellent agent is removed, and an oil repellent agent remains in a crevice.

[0033] Although a graphic display is furthermore omitted, according to a dynamic pressure generating pattern, a herringbone-like dynamic pressure generating pattern can be prepared for spreading of an oil repellent agent in the plate for dynamic pressure generating which makes the shape of flatness. Mutual arrangement with the portion to which oil is applied also in this case, and the portion which is not so can constitute the

hydrodynamic bearing section by the fluid lubrication agent which is oil. Since an above-mentioned configuration can be applied corresponding to drawing 1 thru/or drawing 6 which already explained and was used and it overlaps, the operation explanation is omitted. In addition, since all have applied the oil repellent agent to the case at the dynamic pressure generating pattern, even if it does not prepare a dynamic pressure generating slot, or even if it does not prepare so deeply, a dynamic pressure generating slot can be obtained easily. And reduction of the load torque by oil can be aimed at by applying an oil repellent agent to the portion except the seal section which is the hydrodynamic bearing section and the taper-like gap section which were already explained in the example.

[0034] As mentioned above, although the example of the motor of this invention was explained, a design change thru/or correction, etc. are freedom in the range which does not deviate from the main point of this invention. That is, it can use combining the various partial configurations shown by this example, and also a gestalt, quantity, etc. of the slot for dynamic pressure generating of a hydrodynamic bearing can be selected freely. In addition, in this example, although Rota 3 as a revolution member consists of a hub 10 and a sleeve 4, that by which these were formed in one can also respond. Furthermore, the configurations of a dynamic pressure generating slot are freedom, such as arrangement.

[0035]

[Effect of the Invention] Since the motor of this invention has the above-mentioned configuration, it does the following effect so. According to the motor corresponding to claim 1 of this invention, the fluid lubrication agent is applied to the oil-repellent **** oil repellent agent in like the bearing support which a revolution member and a quiescence member counter by the part except the real up aforementioned dynamic pressure generating slot and the taper-like gap section. For this reason, for an oil-repellent ****** reason, in like a bearing support, a fluid lubrication agent is held at least for the section of the hydrodynamic bearing means accompanying dynamic pressure generating by only the ** taper-like gap section, and a fluid lubrication agent piles up by the part by which the oil repellent agent is applied. And even if the taper-like gap section receives an operation so that a fluid lubrication agent may move, it makes the seal means held in a predetermined gap portion by the surface tension and capillarity which balance corresponding to the applied force. Therefore, at least with the other supporter with which a revolution member and a quiescence member counter, a fluid lubrication agent does not exist on parenchyma, but a fluid lubrication agent is held only to the part of a hydrodynamic bearing means effective in dynamic pressure generating, and the part of the seal means (taper-like gap section) of break-through prevention. For this reason, the load torque by which a revolution member is supported is reduced and it becomes possible to stop the torque loss of a motor effectively also as **** for fluid lubrication agents with high viscosity.

[0036] Moreover, as the manufacture method of such a motor, the oil repellent agent is beforehand applied at least to the bearing support, and spreading of the part of a dynamic pressure generating slot and the taper-like gap section is removed by next processing a hydrodynamic bearing means in that case. For this reason, even if it does not apply an oil repellent agent selectively, since it can carry out easily, manufacture becomes easy. By this, even if components become small or serve as a complicated configuration with the miniaturization of a motor, it can apply easily, and a manufacturing cost can be reduced.

[0037] And according to the motor of claim 2 of this invention, the dynamic pressure generating pattern section in which the dynamic pressure generating pattern was formed of the oil repellent agent is prepared in the hydrodynamic bearing means. Therefore, since the dynamic pressure generating section is prepared without [without it prepares a dynamic pressure generating slot in addition to the above-mentioned operation, and] preparing a dynamic pressure generating slot so deeply, a manufacturing cost can be reduced more. In addition, while the load torque of a fluid lubrication agent is reduced and being able to stop a torque loss, break-through prevention of a fluid lubrication agent can also be aimed at.

[0038] Furthermore, as the manufacture method of the above-mentioned motor, an oil repellent agent is similarly applied at least to a bearing support beforehand, and in case a hydrodynamic bearing means is processed and the dynamic pressure generating pattern section and the taper-like gap section process it, the gap section and a ********** oil repellent agent are removed. For this reason, it is not necessary to apply an oil repellent agent selectively and, and can apply easily also to a complicated configuration, and reduction of a manufacturing cost can be aimed at.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section showing the whole brushless motor concerning this invention.
[Drawing 2] It is the important section expanded sectional view showing a part of brushless motor in drawing 1 .

[Drawing 3] It is the important section expanded sectional view showing a part of brushless motor in drawing 1 .

[Drawing 4] It is the important section expanded sectional view showing a part of brushless motor in drawing 1 .

[Drawing 5] It is the expanded sectional view showing the portion of the sleeve in drawing 1 .
[Drawing 6] It is the side elevation showing the portion of the shaft in drawing 1 .
[Drawing 7] The motor concerning another example of this invention is shown, and a plan, (b), and (c) of (a) are the cross section.
[Description of Notations]
1 Housing
2 Shaft
3 Rota
4 Sleeve
5 Thrust Plate
6 Thrust Covering
7 Stator
8 Rota Magnet
30 Breakthrough
36, 37, 43 Circular sulcus

[Translation done.]

* NOTICES *

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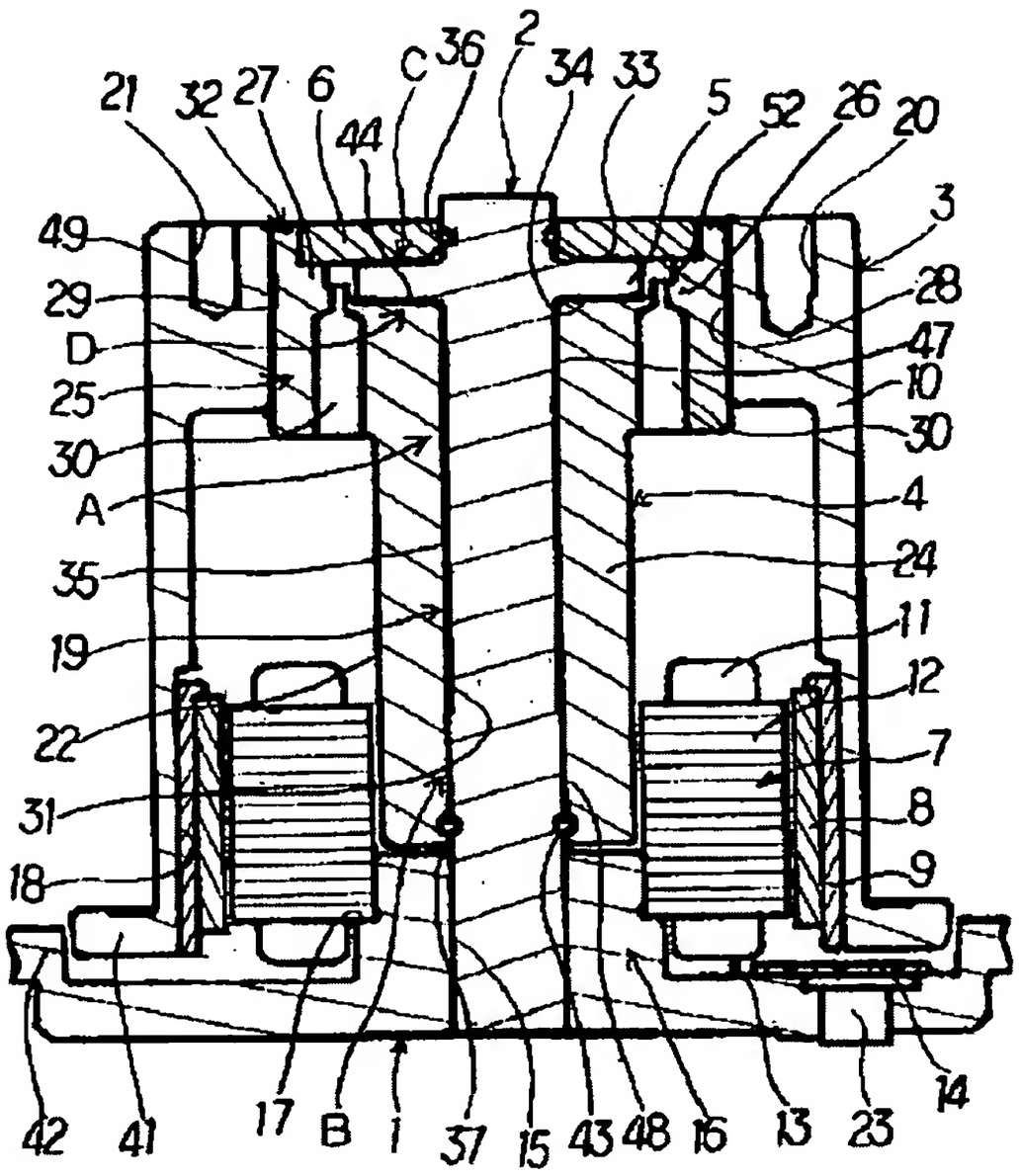
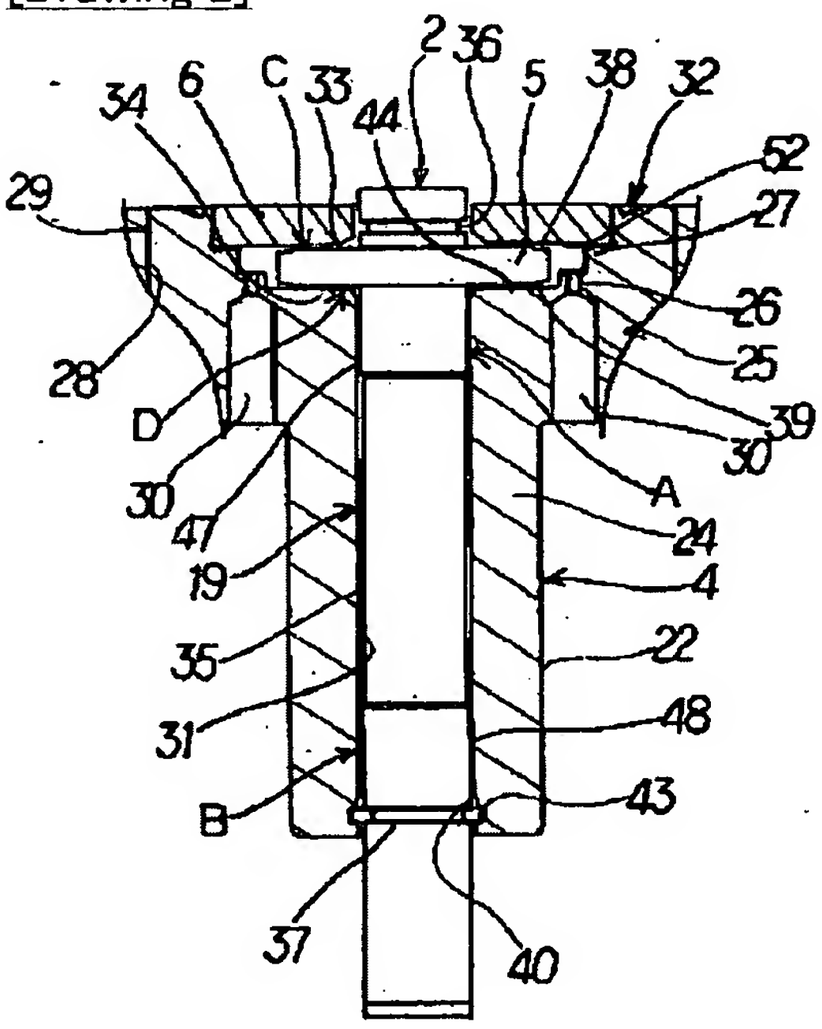
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

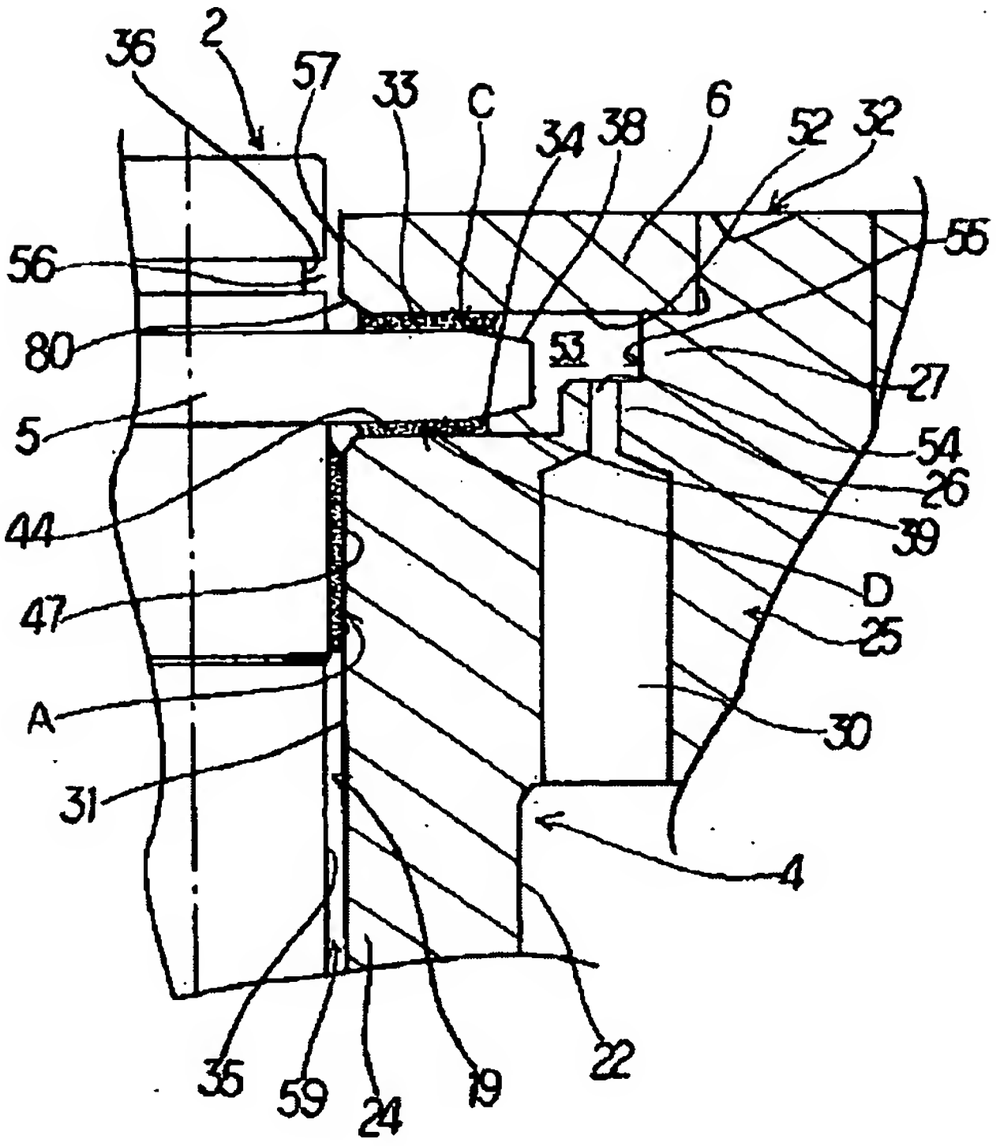
[Drawing 1]



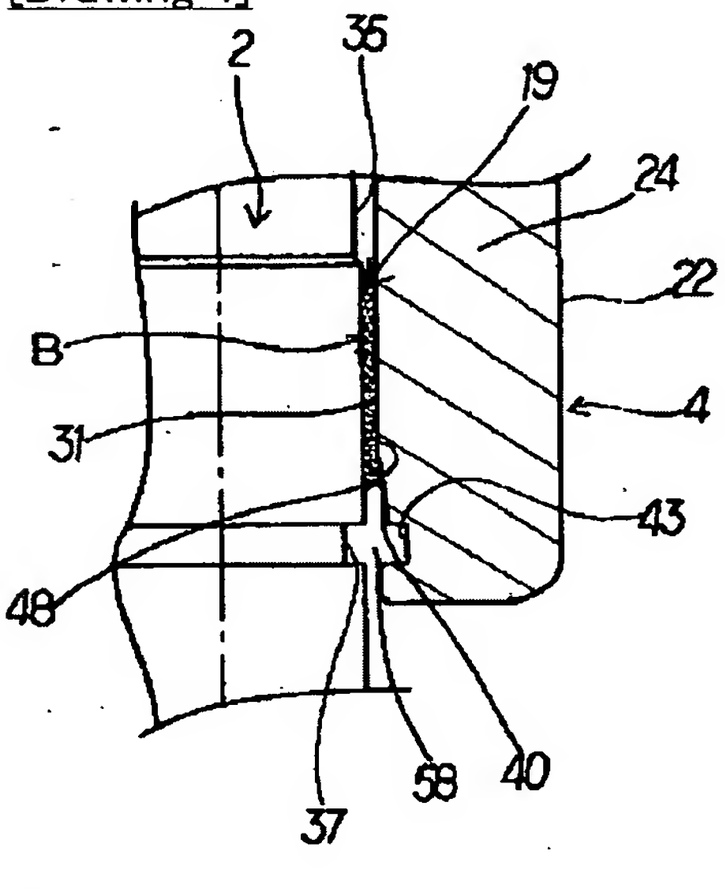
[Drawing 2]



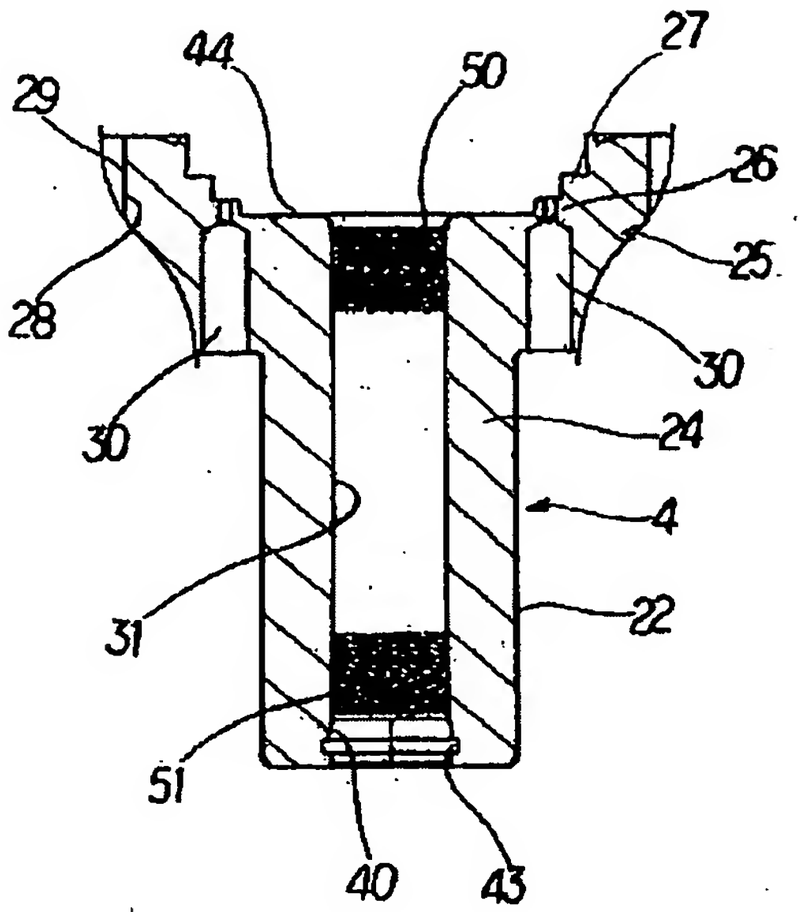
[Drawing 3]



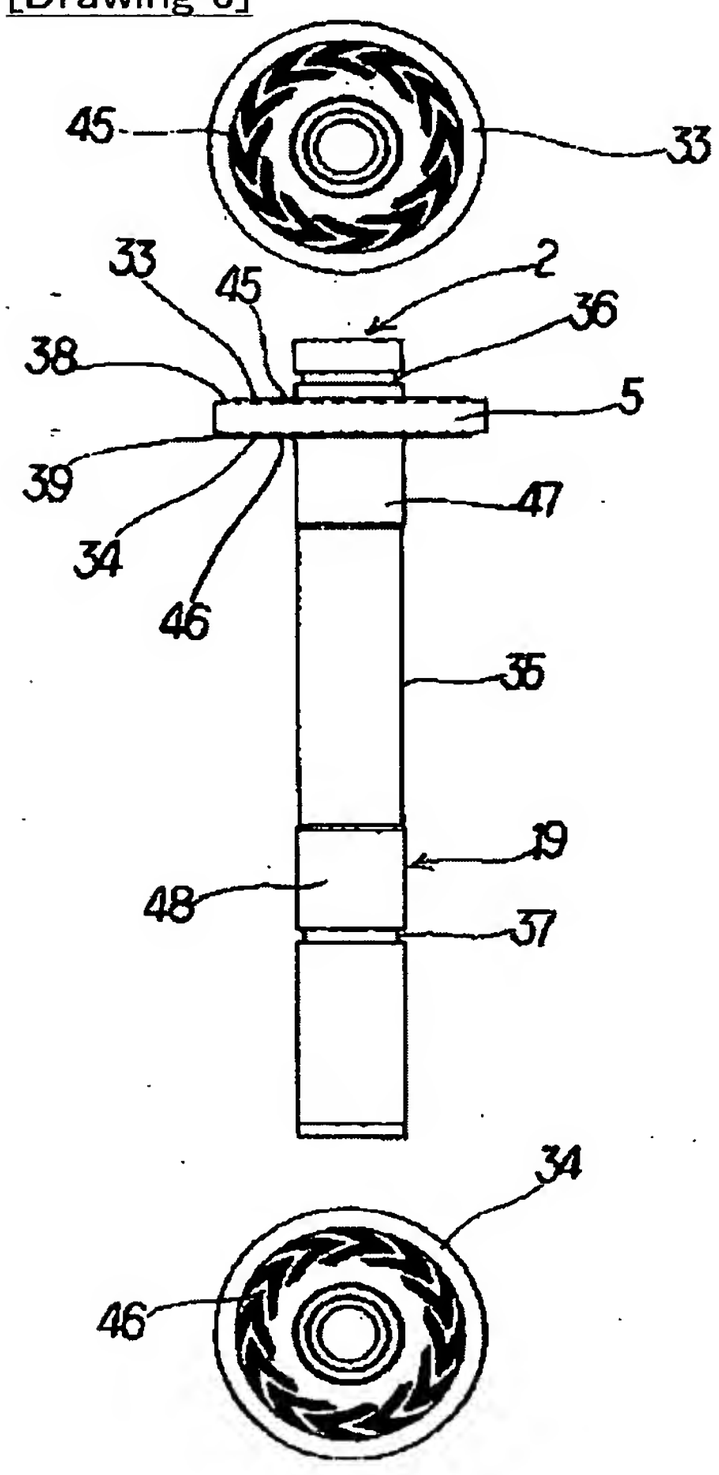
[Drawing 4]



[Drawing 5]

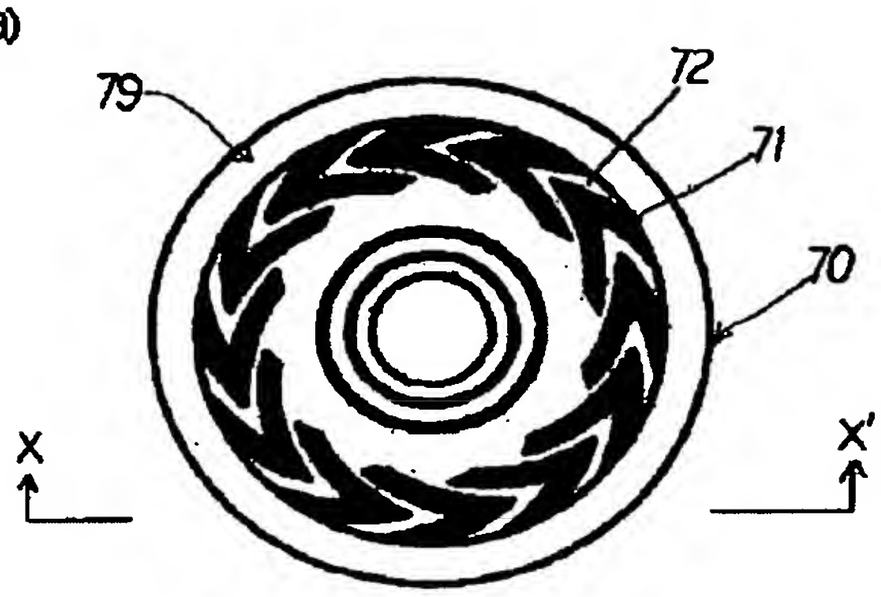


[Drawing 6]

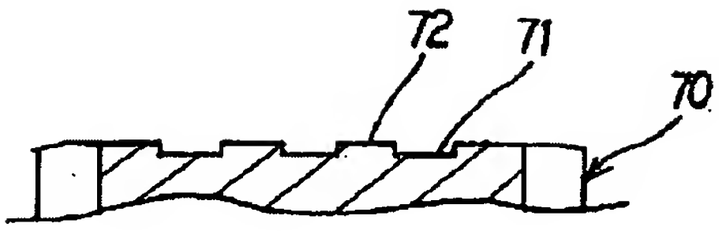


[Drawing 7]

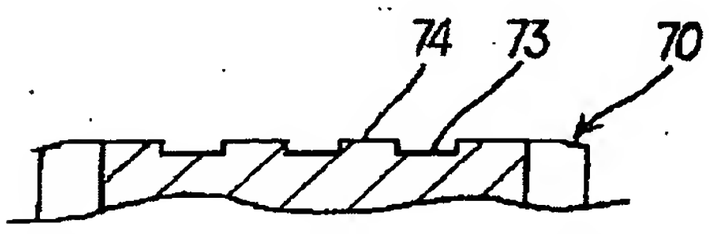
(a)



(b)



(c)



[Translation done.]

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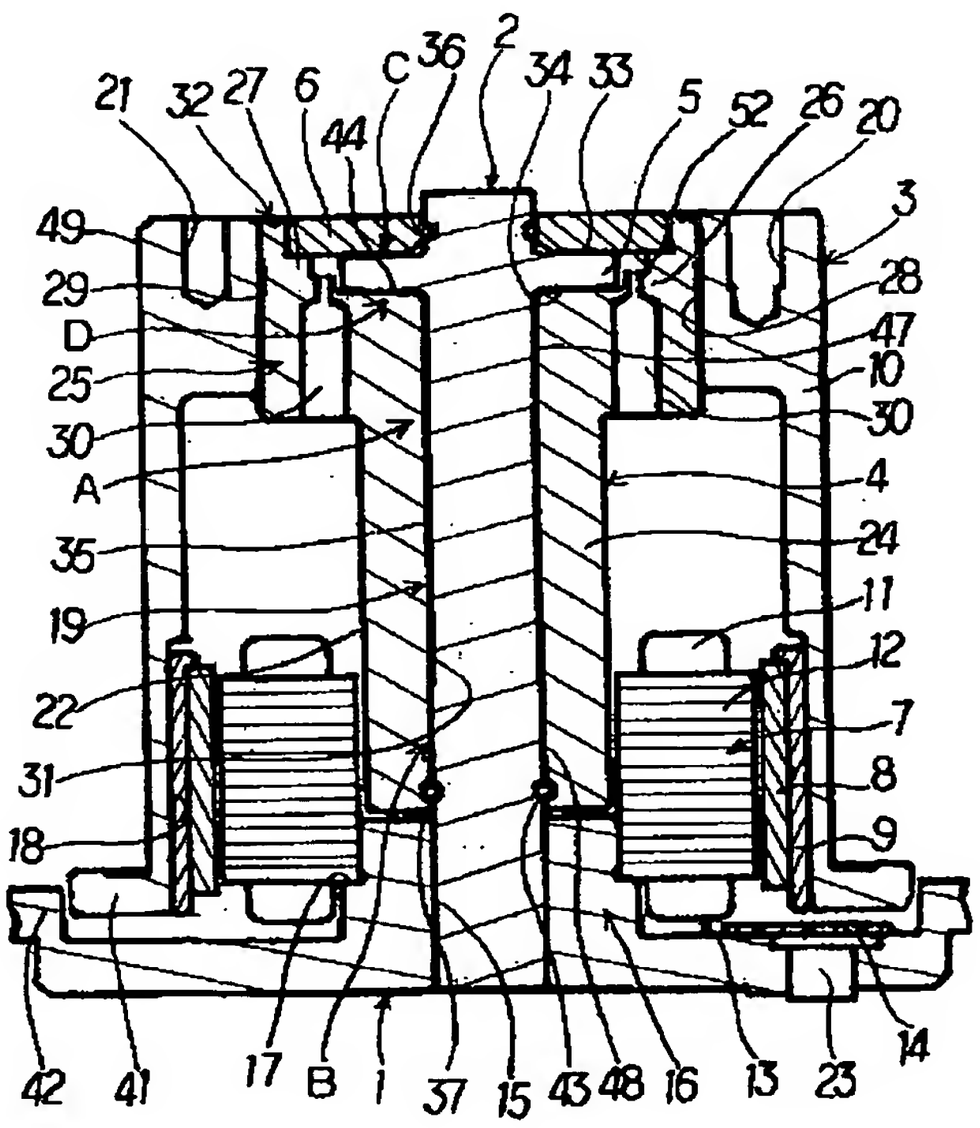
(54)【発明の名称】モータ及びその製造方法

(57)【要約】

【目的】　流体動圧軸受にオイル等の比較的粘度の高い流体潤滑剤を用いても、トルク損失が少なくモータ効率が図れ、容易に製造できること。

【構成】　静止部材１と、前記静止部材１に対して相対回転支持される回転部材３と、前記静止部材１と前記回転部材３との間に介在された流体潤滑剤による動圧軸受手段Ｃ，Ｄと、を具備したモータである。前記動圧軸受手段Ｃ，Ｄには、相対する前記静止部材１と前記回転部材３とのいずれかに動圧発生溝部が設けられ、前記動圧発生溝部の動圧発生端部側には、前記動圧発生溝部における前記静止部材１と前記回転部材３とによる半径方向間隙よりも、該間隙が前記動圧発生端部外側へ向けて順次大きくなるテーパ状間隙部が設けられている。そして前記回転部材３と前記静止部材１とが対向する軸受支持部位のうち、実質上前記動圧発生溝部及び前記テーパ状間隙部を除く部位に、前記流体潤滑剤を撥油する撥油剤が塗布された。



1

【特許請求の範囲】
【請求項１】　静止部材と、
前記静止部材に対して相対回転支持される回転部材と、前記静止部材と前記回転部材との間に介在された流体潤滑剤による動圧軸受手段と、を具備したモータにおいて、
前記動圧軸受手段には、相対する前記静止部材と前記回転部材とのいずれかに動圧発生溝部が設けられ、
前記動圧発生溝部の動圧発生端部側には、前記動圧発生溝部における前記静止部材と前記回転部材とによる半径方向間隙よりも、該間隙が前記動圧発生端部外側へ向けて順次大きくなるテーパ状間隙部が設けられ、
前記回転部材と前記静止部材とが対向する軸受支持部位のうち、実質上前記動圧発生溝部及び前記テーパ状間隙部を除く部位に、前記流体潤滑剤を撥油する撥油剤が塗布された、ことを特徴とするモータ。
【請求項２】　静止部材と、
前記静止部材に対して相対回転支持される回転部材と、前記静止部材と前記回転部材との間に介在された流体潤滑剤による動圧軸受手段と、を具備したモータにおいて、
前記動圧軸受手段には、相対する前記静止部材と前記回転部材とのいずれかに動圧発生パターン部が設けられ、該動圧発生パターン部は、前記流体潤滑剤を撥油する撥油剤により所定動圧発生模様が形成され、
前記動圧発生パターン部の動圧発生端部側には、前記動圧発生パターン部における前記静止部材と前記回転部材とによる半径方向間隙よりも、該間隙が前記動圧発生端部外側へ向けて順次大きくなるテーパ状間隙部が設けられ、
前記回転部材と前記静止部材とが対向する軸受支持部位のうち、実質上前記動圧発生溝部及び前記テーパ状間隙部を除く部位に、前記流体潤滑剤を撥油する撥油剤が塗布された、ことを特徴とするモータ。
【請求項３】　請求項１記載のモータを製造する製造方法であって、
前記回転部材と前記静止部材とが対向する軸受支持部位には、予め前記撥油剤が塗布され、
次に前記動圧発生溝部及び前記テーパ状間隙部が加工されることにより、実質上前記両加工部位には前記撥油剤が除去される、ことを特徴とするモータの製造方法。
【請求項４】　請求項２記載のモータを製造する製造方法であって、
前記回転部材と前記静止部材とが対向する軸受支持部位には、予め前記撥油剤が塗布され、
次に前記動圧発生パターン部の動圧発生模様及び前記テーパ状間隙部が加工されることにより、実質上前記両加工部位には前記撥油剤が除去される、ことを特徴とするモータの製造方法。
【発明の詳細な説明】

2

【０００１】
【産業上の利用分野】本発明は、軸受部分に動圧軸受を用いたモータに関する。
【０００２】
【従来の技術】例えば記録ディスク駆動装置等に組み込まれるブラシレスモータは、駆動負荷の性質上、回転部材を高精度に支持すると共に、振れやガタツキを極力抑えた精度良い回転支持が要求される。こうした要求に応えるため、軸受部分には従来のボールベアリングから、オイルや空気等の流体潤滑剤を用いた動圧軸受手段へ置き換えられ、それに伴う構成が種々提案されている。これにより、回転ムラや振動等が低減され、高精度な軸受支持が実現される。特に流体潤滑剤としてオイルやグリース等を用いた動圧軸受手段では、これらの持つ粘性によって軸受剛性が高くなり、大きな回転負荷に対して良好な軸受支持を得ることができる。
【０００３】
【発明が解決しようとする課題】上記軸受手段によれば、軸受剛性を高くすることができる反面、介在されるオイルやグリース自体の粘性がモータの発生トルクに対し損失として作用する。このため、同一構成のモータであればトルクの低下または実装電流の増加は避けられず、モータの効率を低下せしめる。こうした問題に対処するため、例えば特公昭６２－４５６５号公報に記載されているように、動圧発生部位に応じて潤滑剤の粘度を使い分け、損失トルクを可及的に低減させるよう提案されている。しかしながら、近時におけるモータの小型化・軽量化の傾向において、上記方策はその構造或いは製造工程上、煩雑となり、必ずしも好適であるとはいい難く、何等かの対策が望まれていた。また加えて、扱う潤滑剤に対応して、潤滑剤の軸受部あるいはモータ外部への漏出を防止する方策も望まれていた。
【０００４】本発明は、従来技術に存した上記のような問題点に鑑み行われたものであって、その課題とするところは、動圧流体軸受にオイル等の比較的粘度の高い流体潤滑剤を用いても、トルク損失が少なくモータの効率が図れ、しかも製造の容易なモータ並びにその製造方法を提供することにある。また併せて流体潤滑剤の漏出が防止できるモータ及びその製造方法を提供することにある。
【０００５】
【課題を解決するための手段】上記課題を達成するために、本発明に係るモータは、静止部材と、前記静止部材に対して相対回転支持される回転部材と、前記静止部材と前記回転部材との間に介在された流体潤滑剤による動圧軸受手段と、を具備したモータにおいて；前記動圧軸受手段には、相対する前記静止部材と前記回転部材とのいずれかに動圧発生溝部が設けられ、前記動圧発生溝部の動圧発生端部側には、前記動圧発生溝部における前記静止部材と前記回転部材とによる半径方向間隙よりも、

該間隙が前記動圧発生端部外側へ向けて順次大きくなるテーパ状間隙部が設けられ；前記回転部材と前記静止部材とが対向する軸受支持部位のうち、実質上前記動圧発生溝部及び前記テーパ状間隙部を除く部位に、前記流体潤滑剤を撥油する撥油剤が塗布されてなるものである。

【０００６】また本発明に係る別のモータは、静止部材と、前記静止部材に対して相対回転支持される回転部材と、前記静止部材と前記回転部材との間に介在された流体潤滑剤による動圧軸受手段と、を具備したモータにおいて；前記動圧軸受手段には、相対する前記静止部材と前記回転部材とのいずれかに動圧発生パターン部が設けられ、該動圧発生パターン部は、前記流体潤滑剤を撥油する撥油剤により所定動圧発生模様が形成され；前記動圧発生パターン部の動圧発生端部側には、前記動圧発生パターン部における前記静止部材と前記回転部材とによる半径方向間隙よりも、該間隙が前記動圧発生端部外側へ向けて順次大きくなるテーパ状間隙部が設けられ；前記回転部材と前記静止部材とが対向する軸受支持部位のうち、実質上前記動圧発生溝部及び前記テーパ状間隙部を除く部位に、前記流体潤滑剤を撥油する撥油剤が塗布されてなるものである。

【０００７】さらに本発明の前者のモータを製造する製造方法としては、前記回転部材と前記静止部材とが対向する軸受支持部位には、予め前記撥油剤が塗布され、次に前記動圧発生溝部及び前記テーパ状間隙部が加工されることにより、実質上前記両加工部位には前記撥油剤が除去されるモータの製造方法が提供される。

【０００８】また更に本発明の後者のモータを製造する製造方法としては、前記回転部材と前記静止部材とが対向する軸受支持部位には、予め前記撥油剤が塗布され、次に前記動圧発生パターン部の動圧発生模様及び前記テーパ状間隙部が加工されることにより、実質上前記両加工部位には前記撥油剤が除去されるモータの製造方法が提供される。

【０００９】

【作用】本発明のモータによれば、回転部材と静止部材とが対向する軸受支持部位のうち、実質上前記動圧発生溝部及びテーパ状間隙部を除く部位に、流体潤滑剤を撥油する撥油剤が塗布されている。このため、流体潤滑剤は撥油剤が塗布されている部位では、撥油されるため、軸受支持部位のうち動圧発生に伴う動圧軸受手段の部位及テーパ状間隙部のみに流体潤滑剤が保持され、滞留する。そしてテーパ状間隙部は、流体潤滑剤が移動するよう作用を受けても、その作用力に対応して平衡する表面張力及び毛細管現象により所定の間隙部分で保持されるシール手段をなす。従って回転部材と静止部材とが対向する、それ以外の支持部位では、実質上、流体潤滑剤が存在せず、流体潤滑剤は動圧発生に有効な動圧軸受手段の部位と漏出防止のシール手段（テーパ状間隙部）の部位のみに保持される。このため、回転部材が支持される

負荷トルクは低減され、粘度の高い流体潤滑剤用いたとしても、モータのトルク損失を効果的に抑えることが可能となる。

【００１０】またそうしたモータの製造方法として、予め撥油剤を軸受支持部位に塗布しておき、次に動圧軸受手段を加工することで、その際に動圧発生溝部及びテーパ状間隙部の部位の塗布が除去される。このため、撥油剤の塗布を部分的に施さなくても、容易に実施できるため製造が簡単となる。これにより、モータの小型化に伴って部品が小さくなったり、複雑な形状となっても容易に塗布することができ、製造コストを低減することができる。

【００１１】そして本発明の後者のモータによれば、動圧軸受手段には、撥油剤により動圧発生模様が形成された動圧発生パターン部が設けられている。従って、上記作用に加え、動圧発生溝を設けることなく、動圧発生部が設けられるため、より製造コストを低減することができる。これに加え流体潤滑剤の負荷トルクが低減されトルク損失を抑えることができると共に、流体潤滑剤の漏出防止も図れる。

【００１２】さらに上記モータの製造方法として、同様に予め撥油剤の塗布を軸受支持部位に施しておき、動圧軸受手段を加工する際に動圧発生パターン部、そしてテーパ状間隙部の加工する際にその間隙部、のそれぞれ撥油剤が除去される。このため、撥油剤の塗布を部分的に施さなくてもよく、また複雑な形状に対しても容易に塗布することができ、製造コストの低減をはかることができる。

【００１３】

【実施例】本発明に従うモータの実施例について、添付の図面を参照しながら説明する。図１は、例えば記録ディスクを回転駆動するためのモータであり、その全体を示す断面図である。図２は図１の一部を拡大して示した要部拡大断面図である。そして図３及び図４は、図２を拡大して示した部分断面図である。さらに図５及び図６は、図１に示した部材の断面または側面図である。

【００１４】これらの図において、ハウジング１はアルミ合金から形成され、その中心部には上方（モータ内部側）に隆起して形成されたボス部１６が設けられている。ボス部１６には、その中央部において孔部１５が設けられ、シャフト２の下端部が嵌め込まれて固定されている。シャフト２はハウジング１の取付面に対して、実質上、垂直に取り付けられている。シャフト２は、例えば鉄基合金材等から形成されており、上端部側には円板状をなすスラストプレート５が一体に設けられている。スラストプレート５は、シャフト２の長手（軸心）方向に対して、実質上、直角に形成されると共に、その上下端部３３，３４の面が実質上平行となるよう形成されている。なお、ハウジング１及びシャフト２により、本モータの静止部材となす。

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【００１５】スラストプレート５は、図６に示すように、上下端部３３，３４において、環状に形成されたヘリングボーン状の動圧発生用溝４５，４６が設けられている。そして上下端部３３，３４のそれぞれ外周端には、周方向に均一の肉厚を有した、先細り状のテーパ３８，３９が形成されている。一方、シャフト２の外周部１９における略中央部には、外周部１９の外径寸法より僅かに縮径して形成された縮径部３５が設けられている。そしてその上下方向の両側には、所定の外径寸法で形成された外周面を有する外周部４７，４８が設けられている。外周部４７，４８は、これらと半径方向に外嵌して対面するスリーブ４とにより、ラジアル動圧軸受部Ａ，Ｂが構成される。スリーブ４の内周部３１の対応部には、図５に示すように周方向に形成されたヘリングボーン状の動圧発生用溝５０，５１が設けられている。

【００１６】シャフト２に回転支持されるロータ（回転部材）３は、略円筒状をなすスリーブ４と、スリーブ４の外周側に固定されたハブ１０とを有している。ハブ１０は、例えばアルミ合金から形成され、その外周部４９に例えば回転負荷としての記録ディスク（図示省略）が外嵌して装着される。ハブ１０の鍔４１は記録ディスクが受け止めるためであり、孔部２０はクランプ部材を取り付けるためのネジ孔、そして孔部２１は記録ディスクを固定する際の回り止めのためのケレ孔である。

【００１７】スリーブ４はその全長の大部分を占める円筒状の周壁２４と、その上部に一体に設けられた拡径部２５とからなり、これらはシャフト２に対して同軸状に形成されている。スリーブ４は鉛青銅等の銅合金材料から形成されている。スリーブ４の拡径部２５には、内周側に段部２６，２７が形成されており、段部２６には、軸線方向に貫通した貫通孔３０，３０が回転対称状に２箇所設けられている。スリーブ４における周壁２４の上端部４４は、スラストプレート５の下端部３４と上下（軸）方向へ対向し、動圧発生用溝４６とにより、スラストプレート下側のスラスト動圧軸受部Ｄが構成される。

【００１８】スリーブ４の上部内周側には、スラストカバー６が設けられている。スラストかバー６はスリーブ上端部３２の溝部が加締められて固定されている。そしてスラストカバー６の下端部５２とスラストプレート５の上端部３３とが上下（軸）方向へ対向し、動圧発生用溝４５によりスラストプレート下側のスラスト動圧軸受部Ｃが構成される。これら動圧軸受Ａ，Ｂ，Ｃ，Ｄにはいずれも流体潤滑剤であるオイルが介在するよう充填され、もってロータ３はシャフト２に対して回転自在に支持される。

【００１９】ハウジング１のボス部１６には、その外周上部に段部１７が形成され、段部１７にステータ７が固定されている。ステータ７は、所定の磁極歯を有するステータコア１２に、ステータコイル１１が巻回されてなる。ステータコイル１１から引き出されたコイルリード線１３は、ハウジング上に貼着されたフレキシブル回路基板１４に接続され、さらに図示省略する接続線は絶縁ブッシュ２３を介してモータ外部へ導出される。ステータ７と半径方向へ対向したハブ１０側には、磁性ヨーク９を介してロータマグネット８が装着されている。

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【００２０】本実施例のモータにおける動圧軸受部Ａ，Ｂ，Ｃ，Ｄには、いずれもオイルが介在して設けられているが、そのオイルの保持状態について図３及び図４を中心に以下、更に説明する。スラスト動圧軸受部Ｃ，Ｄにおける間隙、即ちスラストカバー６の下端部５２とスラストプレート５の上端部３３との間隙、そしてスラストプレート５の下端部３４とスリーブ４の端部４４との間隙、のそれぞれには、オイルが毛細管現象により保持されている。スラストプレート５の外周側には上下のテーパ部３８，３９が形成されているため、それぞれの間隙（テーパ状間隙部）に保持されたオイルは、モータの回転・停止等によるオイルの移動や変動が発生しても、テーパ部３８，３９の間における間隙で、表面張力及び毛細管現象の作用により、それに見合う平衡した所定の位置で保持される。従ってこれらの部位において、オイルの変動を実質的に吸収するシール手段となす。そしてこれらの対応するそれぞれの面には、撥油剤等は塗布されていない。

【００２１】スラストプレート５の外周端側には、スリーブ４の端部４４から段部２７へ連設する環状壁５５と、スラストカバー６の下端部５２と、により閉塞される環状の空間５３が生成されている。もし、モータへの衝撃等が加えられた場合、動圧軸受部Ｃ，Ｄに介在されたオイルが空間５３へ飛散しても、空間５３内の環状壁５５や（スリーブ４の）端部４４等にて捕捉されて保持され、しかるべく元の動圧軸受部Ｃ，Ｄへ回収される。空間５３を規定する表面には、オイルを撥油する撥油剤が塗布され、オイルの滑性を高めるよう図られている。なお、段部２６に設けられた貫通孔３０により、モータ外部と空間５３とが連通しており、モータ内外部の気圧差が解消される。このため、モータの温度上昇でオイル等に含有する空気が膨張しても、モータ外部へオイルが押し出されることはない。貫通孔３０の開口５４が段部２６の上端に設けられているのは、端部４４上などに飛散して滞留したオイルが容易に貫通孔３０から漏れ出ないようにするためである。

【００２２】スラストカバー６における内周部５７の下端部８０は、テーパ状に形成されている（テーパ部８０）。これにより、テーパ部８０とスラストプレート５（及びシャフト外周部１９）との間でテーパ状間隙部が形成され、スラスト動圧軸受部Ｃのオイルがモータ外部方向（図の上方）へ移動するよう作用力を受けても、この間隙部で保持され、実質上シール効果が得られる。これら対応する部分の面には、撥油剤が塗布されていな

い。さらに、スラストカバー６（の内周部５７）と半径方向に対向して、シャフト２の外周部には環状溝３６が形成されている。これにより空隙５６が生成され、動圧軸受部Ｃに介在されるオイルは、表面張力の作用により、モータ外部（図の上方）へ漏出することが防止される。空隙５６を規定する、シャフト外周部１９及びその環状溝３６、そしてスラストカバー内周部５７には、それぞれ撥油剤が塗布されており、オイルの漏出をより高めるよう図られている。

【００２３】一方、スリーブ４の下側に位置する動圧軸受部Ｂにおいても、スリーブ内周部３１には、その下端側にテーパ部４０が設けられ（これによりテーパ状間隙部が生成される）ており、前述テーパ部３８，３９と同様の作用により、動圧軸受部Ｂに介在されるオイルのシール手段としている。そしてシャフト２の外周部１９に設けられた環状溝３７と、これと半径方向に対向して（スリーブ４に設けられた）環状溝４３と、により空隙５８が生成され、オイルのモータ外部（図の下方）への漏出が防止される。これらのオイル漏出防止を高めるため、空隙５８を規定する、シャフト２の環状溝３７及びスリーブ４の環状溝４３には、撥油剤が塗布されている。なお、テーパ部４０とこれに対応するシャフト２の外径部４８には、撥油剤は塗布されていない。

【００２４】動圧軸受部Ａ，Ｂの中間部分、すなわちスリーブ内周部３１とシャフト縮径部３５との間のは、半径方向の隙間寸法が動圧軸受部Ａ，Ｂとの間隙寸法より大きく設定されており、空隙５９が形成されている。空隙５９により、動圧軸受部Ａ，Ｂに保持されたオイルは、互いに隔絶される。空隙５９に対応するスリーブ内周部３１には、オイルを撥油する撥油剤が塗布されている。なお、スリーブ内周部３１における動圧発生用溝５０，５１には、撥油剤は塗布されていない。また、シャフト２側には、外周部１９において外径部４７と縮径部３５との全面にわたり塗布されている。なお、動圧発生溝部が設けられた（本実施例ではスリーブ内周部３１側）部位に対応して、その相対する側には、撥油剤の塗布を加工や形状に応じて種々選択することができることはいうまでもない。

【００２５】これら撥油剤の塗布により、オイルは撥油剤により撥油され、塗布面においてオイルの滑性が高められる。このためオイルは動圧軸受部Ａ，Ｂ以外には（ただしテーパ状間隙部を除き）滞留することがなく、従ってオイルは実質上、動圧軸受部Ａ，Ｂにおいて動圧発生に寄与する部分のみ保持・滞留されることになる。そしてオイルは空隙５９において実質上介在されないため、オイルは動圧による軸受支持部分（動圧軸受Ａ，Ｂ）のみに作用し、オイルの持つ粘性による負荷トルクを必要最小限に抑えることができる。すなわち空隙５９の部位にオイルが充填されていた従来に比べ、本モータによればオイルによるトルク損失を効果的に低減することができ、効率の高いモータを得ることができる。特に軸受剛性を高めるために高粘度のオイルやグリース等を用いる際に、モータ効率の向上を図ることができる。同時に、動圧軸受部Ｂのモータ外側（図の下側）においては、撥油剤の作用により、オイルのシール効果を高めている。

【００２６】上記で明らかなように、スラスト軸受部をなす動圧軸受部Ｃ，Ｄにおいても、動圧発生部（及びテーパ状間隙部）以外において撥油剤が塗布されており、同様の効果をなす。軸受支持を行なうための動圧発生部以外の部位へ撥油剤を塗布することにより、トルク損失を低減することができ、さらに撥油剤の表面張力によるオイルの外部漏出を防止することができる。撥油剤としては、例えば、旭硝子社の商品名サイトップ等のフッソ系樹脂材料が用いられている。

【００２７】本実施例では、動圧軸受部Ａ，Ｂにおいて、動圧発生用溝５０，５１がスリーブ４側に設けられているが、これに代えてシャフト２側に設けることができ、或いはこれら両者の組み合わせでも構わない。いずれの場合においても、動圧発生用溝が設けられた部位には、撥油剤が塗布されておらず、それ以外の部位には撥油剤が塗布されることが望ましい。同様に動圧軸受部Ｃ，Ｄにおいても、スラストプレート５に設けられた動圧発生溝４５，４６に代えて、それぞれ対向するスラストカバー６側及びスリーブ４側に設けることができ、これらの組み合わせでも可能である。そして撥油剤の塗布は、動圧発生用溝が設けられた部位以外に行なうことができる。

【００２８】次に撥油剤の塗布方法について説明する。撥油剤を所定の部位や特定の箇所のみに行なうことは、モータの小型化に伴い或いは複雑な外形になる程、困難となるが、以下の製造手順により容易に行なうことができる。即ち図示の構成のブラシレスモータの場合、まずシャフト２においては、図６に示すシャフト単体において、予め全体を撥油剤に含浸させて塗布し、その後、動圧発生用溝４５，４６を、プレスによる塑性加工、或いは切削加工等にて形成する。これにより、加工面であるスラストプレート５の上下端部３３，３４には、動圧発生用溝４５，４６が形成されると共に、撥油剤が除去される。また、テーパ部３８，３９もその際撥油剤が除去される。

【００２９】またスリーブ４では、図５に示すスリーブ単体において、予め全体を撥油剤に含浸させて塗布する。そしてその後、スリーブ内周部３１の動圧発生用溝５０，５１を上記と同様に塑性加工や切削加工等の加工により形成する。これにより、スリーブ内周部３１の加工部位は撥油剤が除去される。またスリーブ４のテーパ状部４０もその際撥油剤が除去される。

【００３０】上記方法によれば、予め部品全体を含浸しておき、その後から不要な部位を除去し、除去の工程を

動圧発生溝の加工、またこれと併せてテーパ状間隙部を形成加工を併せて行なうものである。このため、部品の大きさや形状を問わず容易に塗布することができ、塗布の手間を大幅に削減することができる。部品全体の塗布処理としては、上記撥油剤の入った容器に含浸する方法の他、撥油剤を噴射するなど種々の方法を用いることができる。また、上記実施例の他、動圧発生用溝が動圧軸受部を構成する相手部材側に設けられる場合でも同様の手順で処理することはいうまでもない。

【００３１】次に、図７を用いて本発明の別の実施例について説明する。既に説明したモータにおける動圧軸受部Ａ，Ｂ，Ｃ，Ｄは、図５及び図６に示す動圧発生溝５０，５１（いずれもラジアル動圧）及び４５，４６（いずれもスラスト動圧）によっているが、これらはそれぞれ動圧発生溝が設けられた部分が全域にわたり撥油剤が除去されていた。しかし本実施例では、図７に示す構成が設けられている。図７において、スラストプレート７０の上端部７９側において動圧発生部が設けられた例を示している。（ａ）は上から下に向かって見た平面図であり、（ｂ）はＸ－Ｘにおける断面図である。図において凹設された部分が動圧発生溝部７１であり、凸設された部分が撥油剤塗布部である。

【００３２】あるいは図７において、断面図（ｃ）のように、（ｂ）とは逆に凹設された部分を撥油剤塗布部７３とし、凸設された部分を動圧発生溝部７４としてもよい。これら撥油剤が塗布されることにより、撥油剤が塗布されていない部分との相互関係により、撥油剤による動圧発生パターンが生成され、これにより動圧軸受部が構成されるものである。これらは、いずれも予め撥油剤を全面に塗布しておき、動圧発生溝を形成するときに対応部分が除去されるものである。図の（ｂ）では、概略形成された凹凸を有するスラストプレート面に、撥油剤を全面塗布しておき、溝部７１に対応した加工を行なうことができ、その際溝部７１の撥油剤が除去され、凸部に撥油剤が残るものである。また（ｃ）の場合では、予め撥油剤が全面塗布されており、凸設した動圧発生部７４が加工されて撥油剤が除去され、凹部に撥油剤が残るものである。

【００３３】さらに図示を省略するが、平坦状をなす動圧発生用プレートに、撥油剤の塗布を動圧発生パターンに従い、例えばヘリングボーン状の動圧発生模様を設けることができる。この場合もオイルが塗布されている部分とそうでない部分との相互配置により、オイルである流体潤滑剤による動圧軸受部を構成することができる。上述の構成は、既に説明して用いた図１乃至図６に対応して適用でき、重複するため、その作用説明を省略する。なおいずれも場合においても、動圧発生パターンに撥油剤を塗布してあるため、動圧発生溝を設けなくとも、あるいはそれ程深く設けなくても動圧発生溝を容易に得ることができる。そして、既に実施例で説明した動

圧軸受部及びテーパ状間隙部であるシール部を除いた部分に撥油剤が塗布されることにより、オイルによる負荷トルクの低減を図ることができる。

【００３４】以上、本発明のモータの実施例について説明したが、本発明の主旨を逸脱しない範囲で設計変更乃至修正等自由である。即ち本実施例で示した種々の部分的な構成を組み合わせて用いることができる他、動圧軸受の動圧発生用溝の形態や数量等、自由に選定することができる。なお、本実施例では、回転部材としてのロータ３は、ハブ１０とスリーブ４とから構成されているが、これらが一体に形成されたものでも対応できる。さらに動圧発生溝の形状は配置等自由である。

【００３５】

【発明の効果】本発明のモータは、上述の構成を有しているので、次の効果を奏する。本発明の請求項１に対応するモータによれば、回転部材と静止部材とが対向する軸受支持部位のうち、実質上前記動圧発生溝部及びテーパ状間隙部を除く部位に、流体潤滑剤を撥油する撥油剤が塗布されている。このため、流体潤滑剤は撥油剤が塗布されている部位では、撥油されるため、軸受支持部位のうち動圧発生に伴う動圧軸受手段の部位及テーパ状間隙部のみに流体潤滑剤が保持され、滞留する。そしてテーパ状間隙部は、流体潤滑剤が移動するよう作用を受けても、その作用力に対応して平衡する表面張力及び毛細管現象により所定の間隙部分で保持されるシール手段をなす。従って回転部材と静止部材とが対向する、それ以外の支持部位では、実質上、流体潤滑剤が存在せず、流体潤滑剤は動圧発生に有効な動圧軸受手段の部位と漏出防止のシール手段（テーパ状間隙部）の部位のみに保持される。このため、回転部材が支持される負荷トルクは低減され、粘度の高い流体潤滑剤用いたとしても、モータのトルク損失を効果的に抑えることが可能となる。

【００３６】またそうしたモータの製造方法として、予め撥油剤を軸受支持部位に塗布しておき、次に動圧軸受手段を加工することで、その際に動圧発生溝部及びテーパ状間隙部の部位の塗布が除去される。このため、撥油剤の塗布を部分的に施さなくても、容易に実施できるため製造が簡単となる。これにより、モータの小型化に伴って部品が小さくなったり、複雑な形状となっても容易に塗布することができ、製造コストを低減することができる。

【００３７】そして本発明の請求項２のモータによれば、動圧軸受手段には、撥油剤により動圧発生模様が形成された動圧発生パターン部が設けられている。従って、上記作用に加え、動圧発生溝を設けることなく、またそれ程深く動圧発生溝を設けることなく、動圧発生部が設けられるため、より製造コストを低減することができる。これに加え流体潤滑剤の負荷トルクが低減されトルク損失を抑えることができると共に、流体潤滑剤の漏出防止も図れる。

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【００３８】さらに上記モータの製造方法として、同様に予め撥油剤の塗布を軸受支持部位に施しておき、動圧軸受手段を加工する際に動圧発生パターン部、そしてテーパ状間隙部の加工する際にその間隙部、のそれぞれ撥油剤が除去される。このため、撥油剤の塗布を部分的に施さなくてもよく、また複雑な形状に対しても容易に塗布することができ、製造コストの低減をはかることができる。

【図面の簡単な説明】

【図１】本発明に係るブラシレスモータの全体を示す断面図である。

【図２】図１におけるブラシレスモータの一部を示す要部拡大断面図である。

【図３】図１におけるブラシレスモータの一部を示す要部拡大断面図である。

【図４】図１におけるブラシレスモータの一部を示す要部拡大断面図である。

【図５】図１におけるスリーブの部分を示す拡大断面図

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である。

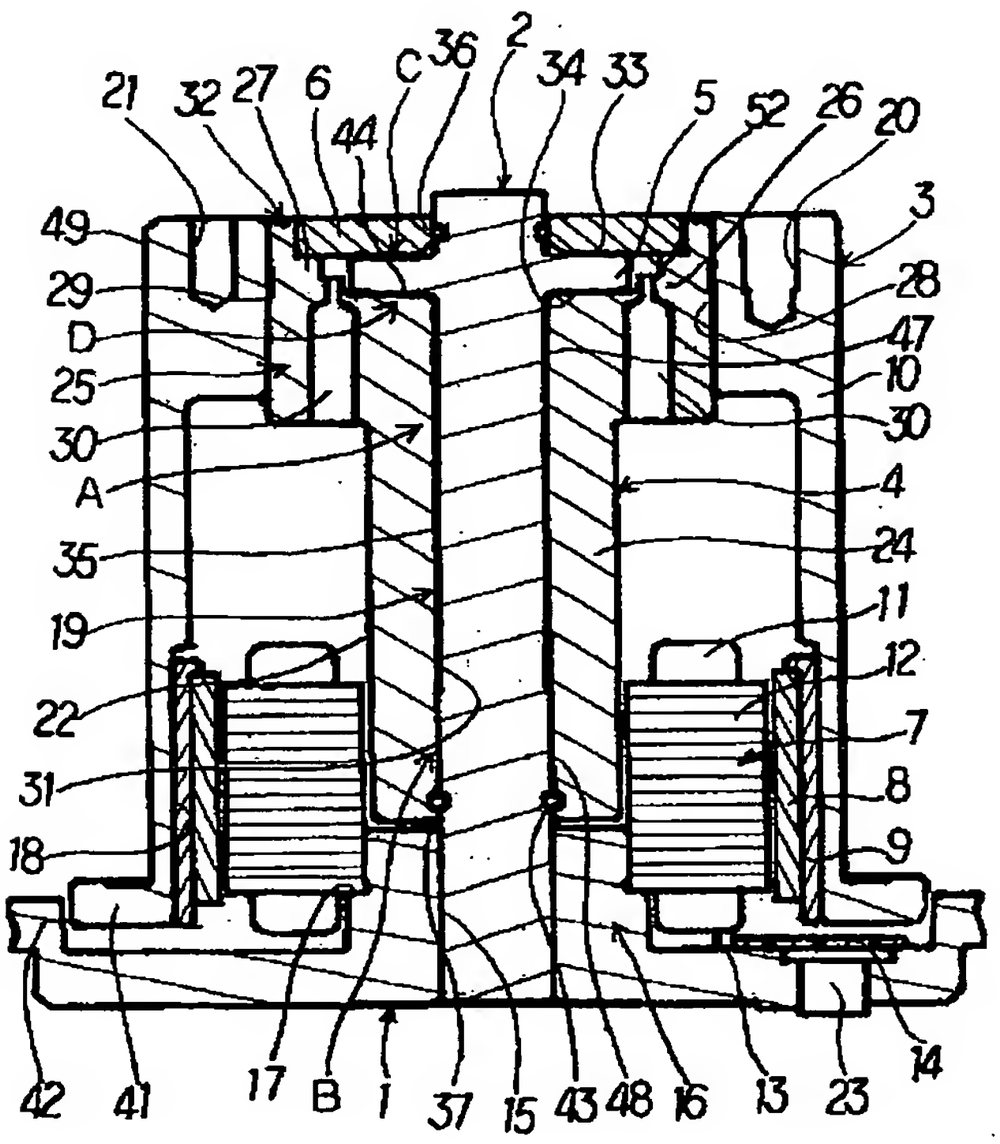
【図６】図１におけるシャフトの部分を示す側面図である。

【図７】本発明の別の実施例に係るモータを示し、（ａ）は平面図、（ｂ）及び（ｃ）はその断面図である。

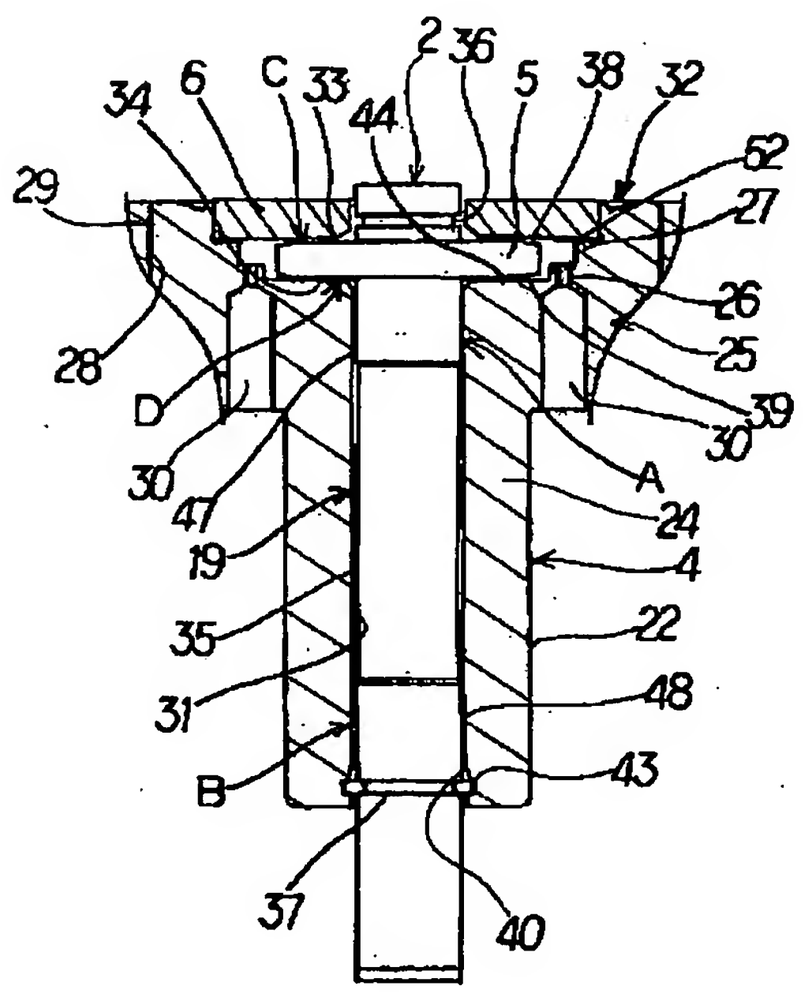
【符号の説明】

１　ハウジング
２　シャフト
３　ロータ
４　スリーブ
５　スラストプレート
６　スラストカバー
７　ステータ
８　ロータマグネット
３０　貫通孔
３６，３７，４３　環状溝

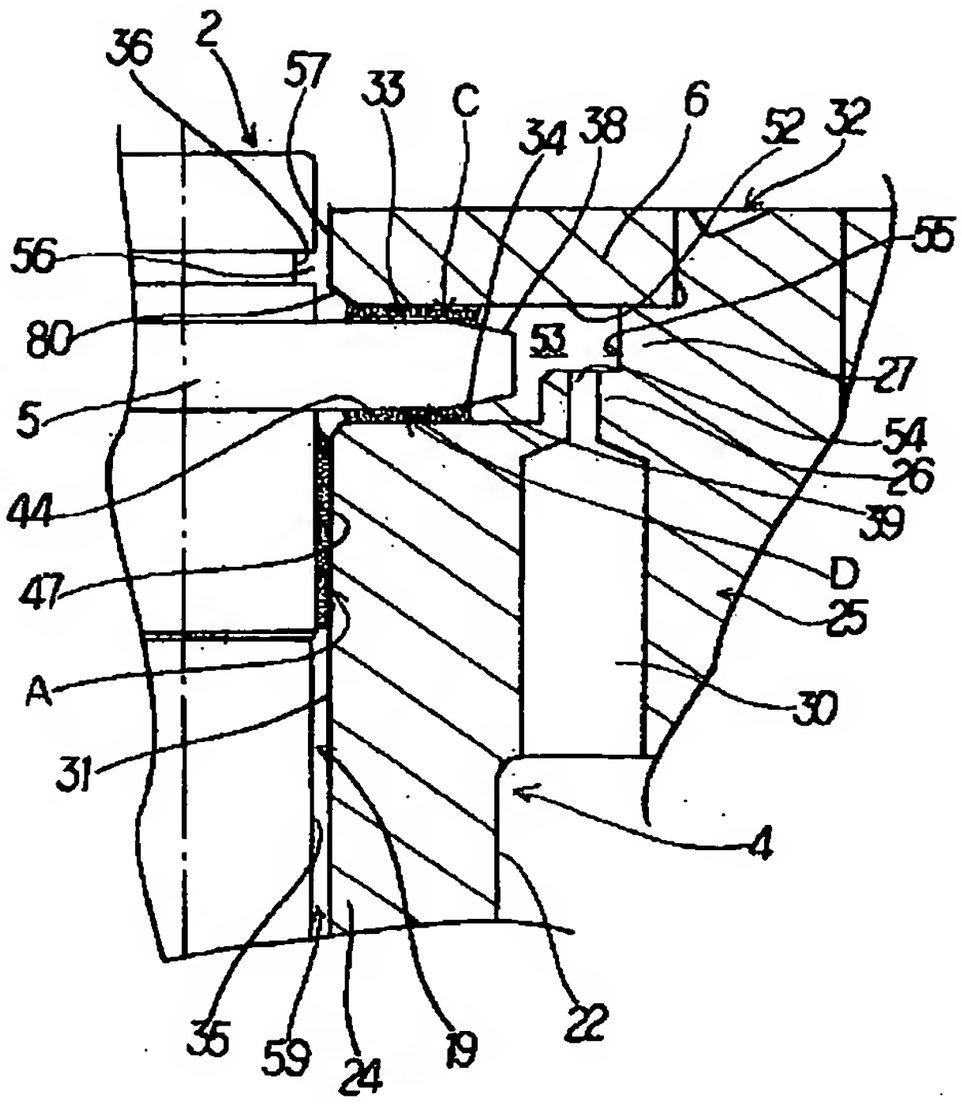
【図１】



【図２】



【図３】


36
2
57
33
C
34
38
6
52
32
56
55
80
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27
5
54
26
44
39
D
47
25
A
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31
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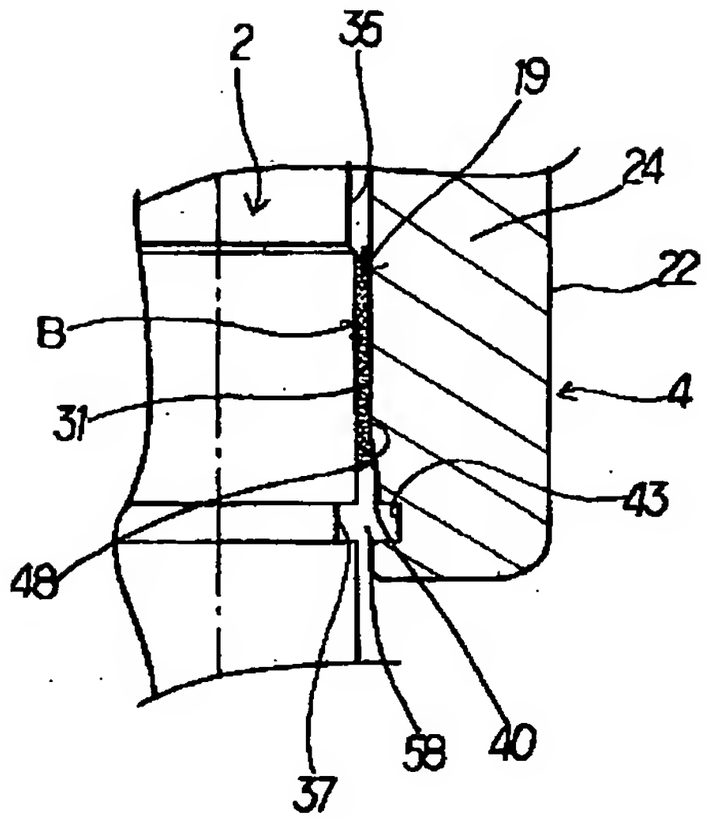
22

【図４】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19
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22
B
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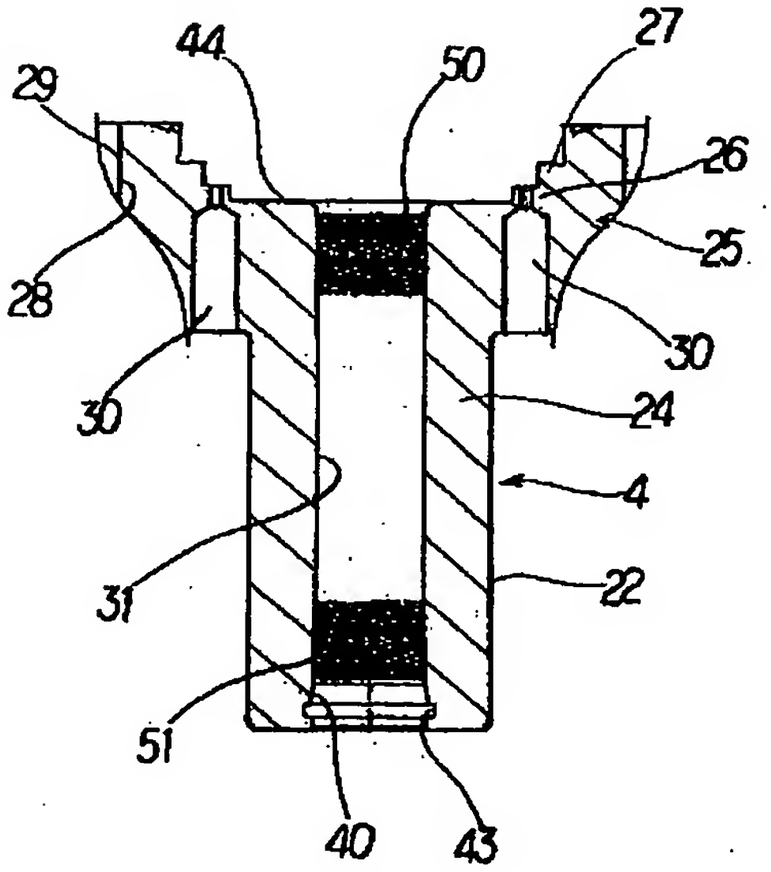
【図５】


44
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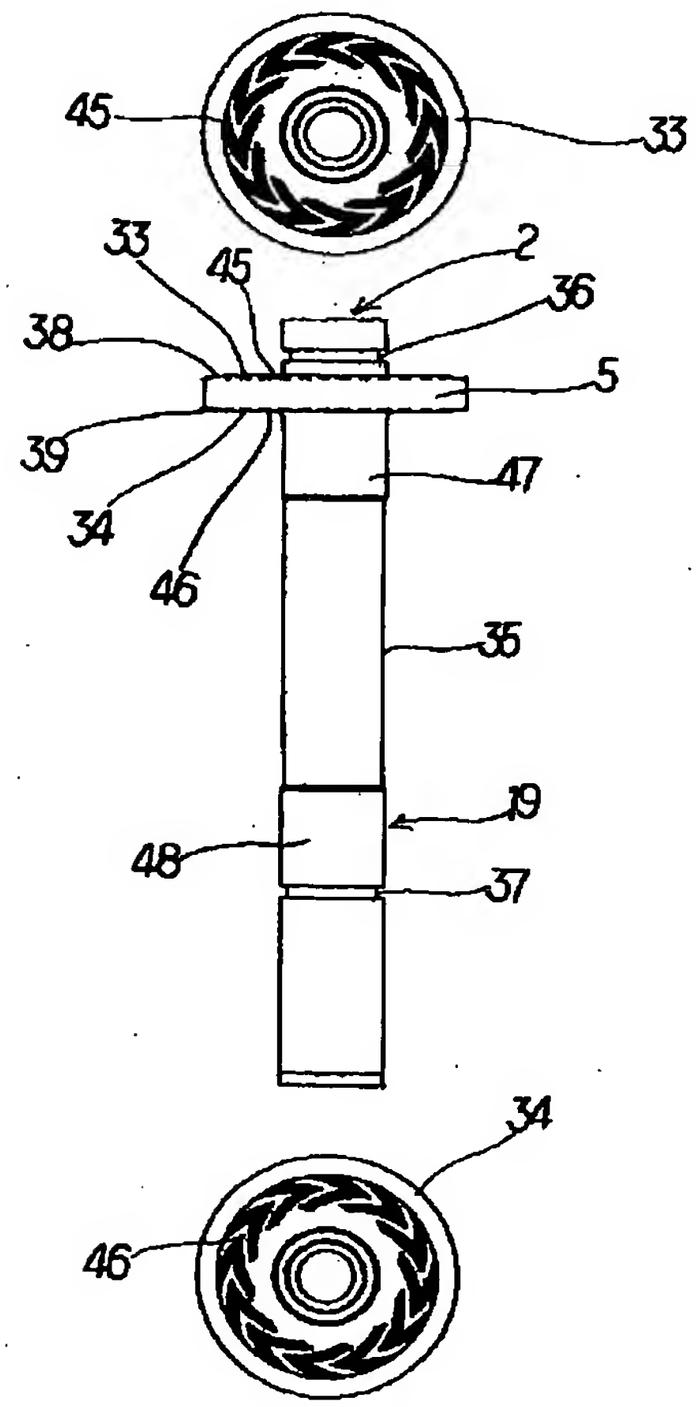
【図６】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【図７】